THE EFFECT OF A COMPUTER-BASED INTEGRATED LEARNING SYSTEM ON THE ACADEMIC ACHIEVEMENT OF HIGH SCHOOL STUDENTS BY RACE AND LEARNING STYLE

By

DORIS KAY PHELPS SMITH

Bachelor of Science
Northeastern State University
Tahlequah, Oklahoma
1982

Master of Science
Northeastern State University
Tahlequah, Oklahoma
1984

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
JULY, 1992

THE EFFECT OF A COMPUTER-BASED
INTEGRATED LEARNING SYSTEM ON
THE ACADEMIC ACHIEVEMENT OF
HIGH SCHOOL STUDENTS BY
RACE AND LEARNING STYLE

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

ACKNOWLEDGEMENTS

I would like to express my appreciation and gratitude to the many people who have supported my efforts. My husband, Jim, has been a steady source of support and encouragement and I would not have been able to complete my degree without him. My daughters, Beverly and Karen, also have encouraged my endeavors and I thank them very much.

My appreciation goes to all of my professors who have guided me throughout this process. Dr. Kay Bull, my adviser and committee chair, has given me the opportunity to explore many issues in education. I thank my committee for their support and guidance: Dr. Katye Perry, Dr. Joyce Friskie, Dr. Bob Davis, and Dr. J. Barbara Wilkinson.

I wish to express my appreciation for the understanding and flexibility of the staff of Frances E. Willard Home to work around my class schedules and deadlines. I especially would like to thank Anna-Faye Rose and Jan McKethan for their encouragement. I hope the program at Frances Willard Home will profit from my experiences.

I am appreciative of members of Tulsa Public Schools for allowing me to work with their school system: Jerry Roger and Dr. Bob Nelson in Research and Evaluation; Dr. Betty Sprankle and Jerry Billings, the principals of both schools; and the teachers who tested the students.

Support has come from librarians both at the University Center of Tulsa and at Oklahoma State University. Jeff Wilkerson at the Computer Center at OSU has been very helpful. My classmates throughout the years have been stimulating, especially Clarice Newton-Johnson, who increased my awareness of cultural differences, and Keith Salyer, who is a kindred NF. Thank you for your interaction.

I am grateful that God has given me the persistence to complete this endeavor and has given me the people I needed to direct me through this process.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

The educational system in America is in the midst of a change. The population being addressed is also in change. Throughout the recent history of education, the effort to address the educational needs of students has produced many theories and many different strategies to help these students learn. Demographics, social issues, cultural diversity, technology, and methods of educational instruction have impacted the effectiveness of the traditional public school. The relationship of several factors which are believed to affect academic achievement are examined.

Background

The path of the school system as it exists today can be traced back to the Ancient Egyptians, Greeks, and Romans who established schools to teach reading, writing and languages in individualized, small-group settings. As populations increased, education became more organized. Different philosophical viewpoints which have influenced education were espoused by philosophers such as Locke, Thorndike, Dewey, Parker, and Tyler (Komoski, 1987). Each philosopher

suggested ways in which he thought learning occurred. These ideas inspired the creation of teaching methods. Teachers learned that by using the structured teaching methods they could facilitate learning. During the Industrial Revolution and the expanding public education enterprise, teachers used the learning systems to instruct. Refinement and integration of the instruction occurred. The first primitive integrated instructional system was the monitorial system of Joseph Lancaster in 1820. This system used wall charts and slates and older students to monitor the younger students. The graded series of linear, sequential lessons were organized into textbooks which became the integrated system of the mid-nineteenth century (Komoski, 1987).

Educational Trends

Romiszowski (1986) said that methodology needs to become even more integrated. Instructional developers lose sight of the goal of effective instruction for learners and abandon partly successful systems to try new methods. This phenomenon was noticed by Dewey in the 1920s and he likened the discarding of potentially good systems to throwing the baby out with the bathwater--throwing both the good and the bad away so a fresh start could be made.

Romiszowski (1986) listed several trends evident in education. More emphasis is being placed on self-instruction and multi-media learning. Student-directed

learning systems and small-group learning systems are being developed. Varying approaches are being examined including group-based and individual-based strategies. The main difference between instruction given by a teacher and instruction given by media is that the emphasis moves from the teacher teaching to the learner learning. Control of instruction is governed in three ways: (1) prescriptive, which compares the individual student's profile with some ideal model and a prescription of learning activities is formed for the student, (2) democratic or student-controlled, which supports individualization for the student's own sake in order to promote individual development, and (3) cybernetic control, which programs the computer or machine-based systems to learn from the learner, adapt to the learner's strategy, and redesign presentations in a conventional tutorial program to fit the learner (Romiszowski, 1986). Romiszowski felt that cybernetics is the most promising control for the future, although he thought that Computer Aided Instruction (CAI) using both prescriptive and student control is useful for presenting routine skills in an interesting manner. Romiszowski believed that the computer-controlled videodisc is a trend for CAI use in the future.

Demographic Trends

Demographic trends will also influence the educational

system. As the population was examined by Hodgkinson (1986, 1987, 1988a, 1988b) through the 1980 Census, several facts are presented which indicate what population educators will be addressing in the 21st century. It will be important for educators who are planning educational programs to know what kind of students the schools will serve.

Hodgkinson (1988b) mentioned three major fertility trends which will affect future demographics. First, there is a decline of white fertility. White, middle-class women are choosing to bear less children (1.7 compared to the 2.1 needed to maintain the present white population). Hispanics and Blacks are maintaining their birth rate. The steady minority birth rate combined with the influx of minority immigrants, has led to a high minority student population in the elementary and high schools (Hodgkinson, 1986, 1987, 1988a, 1988b).

Hodgkinson (1988b) stated that the census also confirms the second fertility trend that there are more female, single-parents rearing the children who will be students. Because of lack of significant job skills, the single parent is increasingly unable to financially support children.

The third trend noted by Hodgkinson (1986. 1987, 1988a, 1988b) is towards increased production and/or diagnosis of children with physical and emotional handicaps. Factors including medically promoting the survival rate of premature babies and family instability contribute to these handicaps.

The student of the 21st century will be characterized by poverty, native languages other than English, physical and emotional handicaps, and ethnic and cultural diversity. An educational trend recently has been to tighten standards for educational outcomes rather than taking steps to ensure that every child has a reasonable chance of attaining them (Hodgkinson, 1986, 1987, 1988a, 1988b).

Hodgkinson (1988b) also projected the type of worker who will be in the workplace in the future. If the trend continues toward a typical 21st century student who is poor, emotionally or physically handicapped, culturally diverse, and does not perform well in school, the service positions that are predicted to be the most prevalent jobs of the future will have this type of worker. Studies have shown that middle class minority students perform as well as middle class white students (Dahlstrom, Lachar, & Dahlstrom, 1986; Hodgkinson, 1988b). It will be the high-achieving students of all races who will fill the technological jobs that will be available in the future. Hodgkinson predicted that the workforce from now to the year 2000 will grow to be 82 percent female, minorities, and immigrants.

The Baby Boomers who are the middle-aged population of today will become the dependent elderly of the 21st century. With a less-skilled workforce producing money, a choice may need to be made between the needs of the elderly who still vote and control some of the money, and the needs of the

student. The businesses of today are already recognizing the lack of basic education of people they hire and are creating educational divisions to educate their workers. The military and government are also educating workers, students, and military personnel. The trend is strong towards life-long learning by adults. An alternate educational route for many young people is to drop out of school to make money and then take the Graduate Equivalency Diploma (GED) exam to get a better-paying job that requires education equal to graduating from high school (Hodgkinson, 1986, 1987, 1988a, 1988b).

Hodgkinson (1988b) has compared states with the best high school retention to those with the lowest. The top ten with the best retention are northern and mid-western states. The lowest retention rates were in southern states and states that had large populations. Hodgkinson determined that the northern state pattern reflected states that have small cities and towns, small schools, low classroom densities, little ethnic diversity and few ghettos. The southern states share the characteristic of having high levels of poverty. The trend is that the states who do not share the northern states' characteristics have lower retention levels (not as many graduating and more dropouts).

This trend has continued until the mounting concern for students and for the future citizens and workers they will become has generated a deluge of research and instructional

strategies to understand the situation and provide ways in which each student could learn.

Selected Strategies to Improve Education

Historically, the goal of organized education has been to improve learning. The means to this goal have been through instructional systems based upon philosophical statements about the nature of learning. Today, the educational trends within instructional systems are toward self-instruction, multi-media learning, and computer utilization (Romiszowski, 1986) and the demographic trends are toward more minority students and a less skilled workforce (Hodgkinson, 1986). These trends indicate an urgent need to update the educational strategies in order to influence the outcome of the trend toward a less skilled workforce in a more positive direction.

Two means that educators are employing to enhance the educational success of learners were examined. One means is learning style, which is encompassed by the broader domain of personality type and is influenced by cognitive style and temperament. The second means is the Integrated Learning System, which addresses the use of the computer and is just one of many multi-media learning methods. Since the educational trend is toward self-instruction (Romiszowski, 1986), the more students know about themselves and their best learning styles, the more effective they will be in

self-instruction. Students who follow the self-instruction path will choose strategies through which to learn. One of the multi-media modes is the Integrated Learning System which is a strategic choice for the self-learner.

These two approaches are attempts by educators to understand how learners learn. The concept of learning style as derived from personality type and the concept of the Integrated Learning System are discussed in the next two sections.

Personality Type/Learning Style

Man has been trying to understand the nature of man since Hippocrates categorized behavior into four temperaments theoretically governed by four bodily fluids of phlegm, blood, black bile, and yellow bile (Keirsey & Bates, 1984). That people are different from each other and that they learn in different ways has been recognized for some time. Hippocrates' temperament theory was further developed into personality theories in the late 1800s and early 1900s. This exploration of human behavior was investigated by Freud, Adler, Spranger, Kretschmer, and others early in the twentieth century. Jung (1946) recognized that each theorist had a valid point of view and reconciled the viewpoints of the era with his theory on personality typology which included how people learned best. Many other approaches to understanding the nature of man also developed

about this time. Snelbecker (1974) identified four basic periods of time when different competing approaches dominated psychological theorizing. While one approach or theory to how humans learn was applied to education, other approaches were being devised.

As researchers began looking for the basic factors that influenced school learning, the concept of learning style as a separate factor began to develop. Karrer (1988) found that elements of learning style began to appear in the literature in the late 1800s. As the study of learning style expanded in 1945, two schools of thought emerged: one was interested in the cognitive dimensions and the other was interested in the applied models and in the multidimensional analysis of styles (Karrer, 1988). From these viewpoints, many definitions of learning style have been devised and attempts to identify and categorize learning style have been made (Henson and Borthwick, 1984).

Elements of learning style were separated into their many components. Components were assessed in the affective and physiological domains and the testing results by different researchers have led to several conclusions. One important conclusion was that when resources and strategies that complement individual preferences are used to teach students, achievement is significantly increased. Dunn and Bruno (1985) substantiated that students are capable of identifying their own learning style characteristics.

Dunn (1983) concluded that students can identify their own learning style at the college, secondary, and elementary levels.

Some theorists believed that a student learned as a whole person, and was not limited by the learning style concept. During World War I Katharine Briggs (Myers, 1980) became interested in the similarities and differences in personality. Briggs discovered that Jung's (1946) typology was similar to the system she was developing. She began to explore and elaborate on the Jungian typology. It was during the revival of study on the subjective nature of man and in response to the suffering and tragedies of war that her daughter, Myers (1980), collaborated with Briggs to develop a testing instrument based on Jung's (1946) personality theory. The instrument was called the Myers-Briggs Type Indicator (MBTI). Jung's theory of psychological types essentially states "that much seemingly random variation in behavior is actually quite orderly and consistent, being due to basic differences in the way individuals prefer to use their perception and judgment" (Myers & McCaulley, 1985, p. 1). The MBTI reflects by self-report the easily recognized reactions and basic preferences of how people perceive and reach conclusions. Myers and McCaulley (1985) stated that if people systematically differ in perception and drawing conclusions, one would also expect

differences in reactions, interests, values, motivations, and skills.

Students bring a multitude of learning styles into the classroom and certain characteristics of these learning styles are associated with specific ethnic groups and are distributed throughout the entire student population (Banks, 1988). Claxton and Murrell (1987) recognized a need to learn more about the learning styles of minorities because participation and graduation rates indicated that education was not serving black students well. Hodgkinson (1987) demographically projects a more diverse ethnic student body for the future. Helping students discover their unique learning styles holds promise for improving the participation and graduation rates of this diverse student body. Henson and Borthwick (1984) stated that if students are aware and informed about their own learning preferences, their ability to develop additional learning styles and to modify their existing learning patterns will increase. Myers (1980) believed that there are just four types of learners, but even if the learners prefer to learn in a certain way, the development of the opposite pole or temperament is important in certain situations.

Technology--Integrated Learning System

Schools are faced with growing concerns over educational effectiveness, efficiency, and productivity and are

turning to educational technology as a strategy to improve education. The computer is one mechanism using the advanced technology to increase individualization especially utilizing computer-based curriculum products known as the Integrated Learning System (ILS) (Komoski, 1987). Komoski defined ILS as one of the approaches to curriculum alignment and reported that it is the system's developer who makes the decision on many educational issues in designing the format of the ILS. Typically, a teacher makes the decision on these issues. Komoski feels that the teacher needs more control in this decision-making process. The ILS is structured in curriculum purpose and content, instructional strategy and tactics, teacher and student roles, the amount and nature of teacher and student control of the system, and how student learning is to be assessed.

Balajthy (1988) distinguished the ILS from a micro-computer in that in the ILS the component workstations are connected to a central computer or memory storage device. The ILS advantages are many. There is an increased capacity for complexity of programming, extensive management and record-keeping abilities. The ILS can use a variety of programs. It can process information quickly. It can store many student records. The ILS also is a multi-tasking system (able to access different parts of software at the same time). Studies have demonstrated the ability of the ILS to increase academic performance. Balajthy (1988) used

the ILS in a Ridge district study and found that it improved reading scores.

Sherry (1992) stated some pros and cons for ILSes. There are several pros listed. An ILS allows students to progress at their own pace, reinforces the weaker students and challenges the brighter ones, and helps teachers find a student's true ability in many curriculum areas. The ILS has a comprehensive curriculum and the students are highly motivated to use it. The reports generated provide much information about student performance that the teacher can use for planning and group remediation. The teacher is allowed to do more holistic teaching instead of focusing on the specific skill one student may need. The ILS does the focusing and reinforcing of these skills.

The points that Sherry (1992) discovered educators did not like were that there was too much reliance on multiple choice questions and drill and practice, not enough student expression, the expense of ILSes, older lessons do not fit the newer computers, the management systems are difficult to learn, and the reports are sometimes hard to understand, and the reports make too many general assumptions about the student based on only ILS performance.

ILSes are doing an excellent job of determining the level of the student and prescribing the correct level of instruction (Sherry. 1992). The individualized instruction, the improvement of basic skills, the remedial aid, and the

ease of use are advantages the educators are seeking. New developments are overcoming some of the cons and enhancing the capabilities of the ILS (Sherry, 1992). Bracey (1991) stated that an effective use of computers may be the Integrated Learning System.

Statement of the Problem

Basic Difficulty and Area of Concern

It is an expressed concern by many educators and businessmen that graduates are leaving school without the basic skills needed to survive in society. The minorities seem to make up a large number of the students not succeeding in school. Another concern is that the school tends to address the Anglo-Saxon culture which may lead to minority underachievement.

One alternative strategy that has been employed to address students at their individual academic levels is using the computer-based Integrated Learning System (ILS). Research shows that students learn best if information to be learned is presented in the preferred learning style modality (Bloom, 1956; Cavanaugh, 1981; Dunn & Bruno, 1985; Henson & Borthwick, 1984; Gregorc & Butler, 1984). The ILS presents information in a linear, sequential fashion which will fit the students who learn in a linear, sequential manner. Historically, there have always been some students

who learn in different ways than the majority of students. In a fixed treatment to increase learning, some students respond well and some students do not because of differences in learning style.

Purpose of the Study

The purpose of the study is to discover if student achievement increases by using the sequential, individualized learning format of the ILS, to determine if achievement is affected by learning style or the demographic factor of race, and to find out what student learning style works best in an ILS environment. The research problem, therefore, is to discover if black or white high school students perform differently in the ILS environment, if learning style (determined by the Myers-Briggs Type Indicator) is a factor in achievement, and if there is any interaction between race and learning style on achievement through use of the ILS. The problem looks at how student characteristics (learning style type) and demographics (student characteristics of different cultures and processing methods) influence learning outcomes which utilize the information processing method in the ILS environment (instructional method).

Questions to be Answered

Because the Integrated Learning System is just one strategy for helping students increase academic achievement,

should this strategy be used to help both black and white students with all learning styles? By examining achievement of students using the ILS, which learning style produces the highest results? Does race difference influence achievement of student using the ILS? Are there any interactions between the different learning styles and the different races which have effect on achievement scores?

Assumptions

1. Each person has his/her own learning style 2. A person's learning style can be identified 3. The Myers-Briggs Type Indicator can help a student identify his or her unique learning style. 4. Learning environments can be appropriately created to enhance learning effectiveness with all learning styles (Karrer, 1988). 5. Instruction can be presented in forms compatible with individual learning styles.

Theoretical Framework

The popular and influential theoretical positions that theorists have assumed on how people learn include the behavioral, cognitive, developmental, humanistic, ecological, and the cybernetic approaches (Romiszowski. 1986). The theoretical base on which this study rests is the cognitive approach. Information Processing Theory focuses on internal cognitive operations and includes the

control of the operations by the individual. This theory entails the rehearsing, organizing, elaborating, and integrating of information by the student which results in a change in the individual's knowledge (memory). The Instructional Theory supports the Integrated Learning System as a treatment which is related to student outcomes of learning (Cronbach and Snow, 1977). Cronbach and Snow (1977) outlined a general method using aptitude/treatment interactions, for relating characteristic of students (learning style) to instructional methods (Integrated Learning System). The Myers-Briggs Type Indicator that identifies learning style was theoretically based on Carl Jung's (1946) theory that behavior could be categorized into types. Jung's type-theory says all persons can be classified into a basic type of personality which Myers-Briggs has translated into an assessment that identifies types with specific cognitive styles of learning. Keirsey and Bates (1984) temperament theory draws from the theories of several of the early psychologists combining compatible ideas to reveal a different interpretation of learning style.

Recent educational philosophy has emphasized the individual responsibility of the learner. The rationale of programmed instruction, according to Gagne' (1971), is to provide the individual learner with all the help which can be provided (printed statements, pictures, direction,

self-quizzes, or anything else), and let the learner undertake his or her own learning. Gagne' believed that it was necessary to give material to the individual so that individual would neither be held back in learning, nor pushed forward before the mastery of essential pre-requisites.

Hypotheses

H1: Students in the Control group will perform the same for reading as the students using the Integrated Learning System regardless of race or learning style with no interaction between race or learning style.

H2: Students in the Control group will perform the same for math as the students using the Integrated Learning System regardless of race or learning style with no interaction between race or learning style.

Significance of the Study

America has placed a high value on education. American forefathers established schools to transmit the values of society to the youth and to prepare them to be productive citizens when they became adults. Success in school paved the way for success as an adult in an Anglo-Saxon setting. As young adults, the youth of America replace the older workers as they retire and it is that work force that supports the older and younger generations, cares for the

environment, and strives for world peace. This cycle has continued for many years.

The demographics that Hodgkinson (1988b) pointed out revealing characteristics of areas in the United States with high and low student retention in the high school. These differences in population and the trends that indicate that more typically impoverished minorities will be populating the areas already with low high school retention rates, suggests that focusing attention on how education can help will be of major importance in the near future.

The importance of this study lies in promoting increased awareness of (a) differences in learning, (b) the minority population increase, and (c) the Integrated Learning System as a strategy for learning.

Definition of Terms

Integrated Learning System (ILS): Bracey (1991) defined an ILS as a popular but expensive hardware/software system with many student computers networked to a central computer that has curriculum software and a management system to track student performance.

Computer Assisted Instruction (CAI): CAI is software that acts as a tutorial for the student in presenting information, often branching to deal with different levels of understanding. CAI often does not have computer management of student responses.

Cognitive style: Messick (1976. p. 5) defined cognitive styles as "consistent individual differences in preferred ways of organizing and processing information and experience conceptualized as stable attitudes, preferences, or habitual strategies which determine an individual's typical mode of perceiving".

Learning Style: There are many definitions of Learning Style. Curry (1983) suggested that there are three levels of learning behavior. On the first level, fundamental control of learning behavior is the central personality which pervades all perceiving and decision-making. This control is translated by the middle level of information processing. On the third level, the learning behavior can be observed. The central personality level includes definitions by Gregorc (1984), Keirsey and Bates (1984), and Myers (1980). The second level of information processing includes a definition by Karrer (1989). The observational level includes definitions by Dunn, Beaudry, and Klavas (1989); and Dunn, (1984). Dunn, DeBello, Brennan & Murranin in 1981 found that there are essential similarities between definitions. The different models described similar phenomena from different vantage points (Dunn, 1984).

Limitations of Study

There are certain limitations to this study which are important to note. The selection of the subjects was

limited to those students who attended the two mid-western, urban high schools. Most students attended the school in the area in which they lived. Another limitation was the expected mortality of subjects because of the high mobility rate of students, or failure of a subject to take a required part of a test. A final limitation was the length of time of the study. To obtain power for the study, a large number of students was needed. In order to process students through the reading section of the Academic Study Skills classes and to provide adequate computer lab use, the study was set for 4 quarters, or one school year. After the first year of testing, the preliminary data indicated a notable lack of subjects with all three test scores, the pretest, the posttest, and the MBTI. Arrangements were made with both schools at their convenience to administer the missing tests to these students. This method was partly successful because students were either absent from school, involved in other classes, or withdrawn from school. Student mobility and school absence were noticeable factors in student mortality. The number of subjects with completed test sets was still limited, so the study was extended two more quarters to build the base of matching scores.

Outline of the Remainder of Chapters

The remainder of the chapters consists of a review of literature, a description of the methods to be used, the

analysis and evaluation of the findings, the summary and conclusions, and a reference list. Chapter Two, the review of literature, includes an overview and is divided into four sections with one section each devoted to the areas of temperament and learning style, race, demographics, and the Integrated Learning System.

The methods chapter has been divided into the following sections: description of research methodology, research design, selection of subjects, instrumentation, classroom procedures, data collection and recording, data processing and statistical analysis, methodological assumptions, limitations, restatement of hypotheses, and summary.

Chapter Four is devoted to analyzing the findings of the data and to interpreting the findings. A summary concludes the chapter. Chapter Five concludes with a summary of the information presented in the previous chapters, a section on conclusions drawn, and recommendations for the future. The last section is a list of references used to research the material in the study.

CHAPTER II

REVIEW OF THE LITERATURE

Overview

The review of literature is divided into four sections addressing pertinent research in the areas of temperament and learning style, race, demographics, and integrated learning systems. The first section reviews the various research on learning style and personality temperament that affects students in their attempt to succeed in school. The second section reviews important aspects of race pertaining to education and examines the differences and similarities of cultures as they affect the learning process. Section three examines the demographic background of the projected student population in the future. The last section reviews research on the integrated learning system and its use as a teaching strategy.

Temperament and Learning Style

Temperament

One of the first thinkers to categorize people into distinct types was Hippocrates (Keirsey & Bates, 1984). He

observed that behavior could be divided into four categories which he thought were influenced by the bodily fluids of blood, yellow bile, black bile, and phlegm. Keirsey and Bates (1984) noted several theorists since then have observed similar behaviors and have divided behavior into either polar or bipolar orientations. The ancient Greeks personified behavior in their gods. Over time, the study of behavior characteristics gave way to standardization and the idea that people are equal and the same. Keirsey and Bates (1984) in looking at the type differences in people said that the idea that people are fundamentally alike appears to be only a 20th century notion probably stemming from the spread of democracy in the Western world.

Four periods of theoretical differences were identified by Snelbecker (1974). Snelbecker stated that during the first period, the expectation in the late nineteenth century was that a single science of psychology would emerge. What actually happened was that different schools of psychology developed as competing comprehensive systems.

The second era which was identified (Snelbecker, 1974) lasted from 1900 to 1930 when the schools of psychology dominated thinking. Five schools were conceptualized. The structuralists were concerned with the analysis of consciousness into its elements, in other words, its structure. The functionalists were interested in human behavior in terms of the functions that mental activity

served in aiding the individual in adapting and coping with the environment. The Gestalt psychologists said that there was more to learning than just behavior and that cognitive processes were important. Their point was that the whole of the individual was not just the sum of the parts. The behaviorist movement broke learning behavior into small stimulus-response detail in order to identify basic elements of behavior. The fifth school was psychoanalysis which refers to both a theory and a method of treatment. This school of thought influenced evolving learning theory by calling attention to the fact that personality characteristics are formed in childhood and that unconscious behaviors influenced reaction to learning situations (Snelbecker, 1974). It was the school of psychoanalysis which fostered Jung (1946) and his thinking on the personality type theory.

The third era identified by Snelbecker (1974) was the era of comprehensive learning during the years 1930 to 1950. It was during this time that learning processes came to have a dominant influence in psychology theory construction. The competition among the comprehensive learning theories influenced the kinds of research which were conducted on learning processes. The learning theories could be divided into two groups--the conditioning theories and the cognitive theories. The conditioning theorists were characterized as believing that the neurophysiological changes that occurred during learning were peripheral rather than central. The

cognitive theorists contended that a central change in an individual's conception of a situation occurred even with sensory motor learning.

The fourth period covering psychological approaches was a time of fact-finding and use of a miniature-model approach to theory construction. This was a mid-century transitional period which Snelbecker (1974) believes happened because psychologists were defining psychology differently than it had been defined earlier. Snelbecker suggested that traditional learning theory lost its appeal when the theory could not be applied to practical problems. This was also a period of reemergence of interest in how a man feels as well as how he behaves. The early twentieth century psychologists were interested in introspectionism or the feeling aspect of behavior. When rigorous research methods and quantifiable forms of data were required in order to be studied by the scientific method, psychologists reduced complex human experiences to their simplest form, usually overt behavior. Other psychologists contended that subjective experience as well as overt behavior should be taken into account. This was a humanistic approach to psychology. Snelbecker thinks that comprehensive learning theories and the humanistic psychology movement developed alongside of each other.

Jung (1946) developed a detailed personality approach to explaining human differences. He theorized that there

were two attitudes of personality which he called extraversion and introversion. These attitudes were labeled with the letters E and I. Each attitude had several functions which influenced personality. With these attitudes, one function existed which an individual used with more ease and used more often to face the world. This function was the dominant function. In translating, explaining, and reiterating Jung's theory of personality types, DeLaszlo (1959) presented the layman with the global perspective as well as the minute divisions of Jung's personality theory. DeLaszlo explains that Jung determined that people tend to understand everything in the sense of their own type. An emphasis was placed on the fact that both introversion and extraversion functions exist in all human beings. Individuals choose one or the other depending on which function energizes them. Jung stated that people naturally alternate functions throughout the normal course of life.

Jung (1946) explained that there are four functions with opposite poles. These four functions can be either introverted or extraverted. If one function prevails, a distinctive type results. A person belongs to either the extraverted group or the introverted group. The individual differences lie in the functions of sensation (S), intuition (N), thinking (T), or feeling (F). The general attitude of group membership indicates the direction of general interest in life. The fourth dimension of judging or perceiving,

labeled J or P, was referenced by Jung, but Myers (1980) enhanced its description. The JP difference deals only with outward behavior.

From these bipolar functions, a four-letter combination or letter set is generated by the subjects' preferences. The function types play a principle role in how an individual adapts or develops an orientation to life. These types are universal and override distinction of sex, class, and education. DeLaszlo (1959, p. 189) explained that attitude type is a universal phenomenon and it is the "relation of adaptation" between the subject and the object which modifies effects of both poles.

Jung (1946) mentioned a secondary, inferior, auxiliary function which had different characteristics than the dominant function and served as a balance for the dominant function. Myers (1980) extended Jung's theory and elaborated on the auxiliary function which Jung simply mentioned as being present.

Myers (1980) was part of the movement in the 1960s interested in how man feels and how he behaves (Snelbecker, 1974). The Myers-Briggs Type Indicator which Myers and her mother, Katharine Briggs, developed, aims to identify through self-report the basic preferences of people in regard to perception and judgment. Myers enriches Jung's (1946) terminology and makes the theory easier for us to understand. This short introduction of the four basic

preferences which direct the use of perception and judgment will be elaborated upon in a later section. The preferences are the Extraversion (E) or Introversion (I), Sensing perception (S) or Intuitive perception (N), Thinking judgment (T) or Feeling judgment (F), Judgement (J) or Perception (P). The E or I preference indicates a choice between the outer world of people and things (E) and the inner world or ideas (I). The S or N preference indicates the way in which an individual likes to interact with the world, either through working with known facts (S) or through looking for possibilities and relationships (N). The T or F preference describes the method an individual chooses to decide on things, either based on analysis and logic (T) or on personal values (F). The last preference, the J or P preference, indicates how an individual likes to approach life, either in a planned, orderly way (J) or a flexible, spontaneous way (P). The preferences are summarized by Myers and McCaulley (1985) in Table 1.

TABLE 1

THE FOUR PREFERENCES OF THE MBTI

Index	Preferences between	Affects Choices as to
EI	E Extraversion or I Introversion	Whether to direct perception judgement mainly on the outer world (E) or mainly on the world of ideas (I).
SN	S Sensing perception N Intuitive perception	Which kind of perception is preferred when one needs or wishes to perceive
TF	T Thinking judgment F Feeling judgment	Which kind of judgment to trust when one wishes to make a decision
JP	J Judgment P Perception	Whether to deal with the outer world in the (J) attitude using T or F) or in the perceptive (P) attitude (using S or N)

Myers and McCaulley (1985)

Jacobi (1943) formulated a synopsis of Jung's work and constructed many diagrams of the psychological descriptions of Jung, which clarified Jung's theory. Jacobi stated that Jung's theory of dynamics is characterized by the law of inevitable complementariness, which, in essence, states that there is always an opposition to an energy at some time or another. It is the psychic energy or consciousness that directs the dynamic movement from one difference to its opposite.

Learning Style

Temperament theory lay dormant for several years until interest in individual differences stimulated studies in learning styles in the 1960s and 1970s (Curry, 1983). Interest waned as psychologists considered cognitive style research as indefensible as a field of study (Keefe, 1986). Interest turned toward between-group differences such as racial, sexual, and social class differences (Curry, 1983). Educators recognized value in learning styles but confusing definitions and differences in the behavior measured has resulted in difficulty in making significant progress in learning style application.

The field of learning style research is fragmented (Keefe, 1986). Karrer (1988) noted that there are many instruments and models which are used to identify a student's learning style. Karrer said all of these

instruments and models are based upon assumptions by the designer. They are limited by the research approach, but the instruments and models have definite strengths.

Classification of Learning Style Models

Most learning style literature examined the improvement of the immediate and long term results of teaching-learning situations. Curry (1983) organized nine psychometric learning style models into three levels resembling an onion. Curry proposed this organization to classify the different learning style conceptualizations. The inner core or center layer of the onion Curry called the Cognitive Personality Style. Curry suggested that the fundamental control of learning behavior is the central personality. In this layer the student adapts and assimilates information. There is no interaction with the environment at this level. The Cognitive Personality Style level represents the underlying personality dimension. The second or middle level of the onion is called Information Processing. At this level the student processes and assimilates information through an intellectual approach. No direct interaction with the environment is observed at this middle level. The outermost layer is called Instructional Preference. Learning behavior is observed on the third level by interaction with the environment. Instructional Preference refers to the type of

learning environment a student would prefer if given a choice.

The Myers-Briggs Type Indicator is classified in the Cognitive Personality Style level in Curry's (1983) organization. Curry emphasized that central personality dimension models have wide applicability in predicting behavior, but each one specifically includes learning behavior. Curry contended that the cognitive personality level of learning style should be more stable than the other levels of learning style. The internal consistencies of test-retest correlations support the contention (Curry, 1983, p. 10). The average internal consistency reported for the cognitive personality level is .86, for the information processing level it is .68, and for the instructional preference level it is .63. Curry felt that given its stability and predictability, professionals and the workforce can benefit from learning style development.

Claxton and Murrell (1987) also classified learning style into levels but add the dimension of social interaction as the third level with instructional methods classified as the forth level. They also defined two orientations: the splitters who analyze information and break it into smaller parts, and the lumpers who watch for patterns and relationships between the parts. Claxton and Murrell pointed out that in helping students understand their own preference for learning and teaching them ways in

which to cope more effectively in courses taught in ways inconsistent with their style of learning, students can take increasing charge of their own learning which empowers them to be successful lifelong learners.

In trying to coordinate the learning style research, Keefe (1986) headed a task force for the National Association of Secondary School Principals to examine and develop a research-based learning style assessment. The result was the Learning Style Profile which, according to Curry's (1983) classification, related learning styles to the middle level of information processing. The Learning Style Profile also identifies elements of Curry's cognitive personality level and of the instructional preferences level. Keefe viewed learning as taking place in one or more of three domains--the cognitive, the affective, or the physiological. The domains are similar to Curry's onion layers. Keefe recognized that students show different strengths in the different domains. Keefe (1986) favored the cognitive dimension and states that learning style is gestalt and that it is the sum, or gestalt, of cognitive, affective, and environmental elements which is termed learning style. Keefe stated that many schools approach learning in a mechanical or habitual manner, providing the same method of teaching for all students instead of recognizing individual needs. Whether the approach is cognitive or applied, the common finding of the many studies

done on learning style and how students learn is that students learn better when teaching matches the students' modality (Bloom, 1956; Cavanaugh, 1981; Dunn and Bruno, 1985; Gregorc and Butler, 1984; Henson and Borthwick, 1984).

Keefe (1987) cautioned that most instruments have been constructed to assess factors in only one or two of the three domains--cognitive, affective, or physiological. Keefe described the Myers-Briggs Type Indicator as a measure of the cognitive and affective domains. Keefe, for comparison, described the Learning Style Inventory by Dunn, Dunn and Price (1978) as a measure of the affective and physiological domains. Ferrell (1988) observed that since Herb Thelen first coined the phrase "learning style" in 1954, research in the field has verified that differences in learning style do exist, and that positive outcomes result by matching learning style with instruction and environment.

Dunn and Dunn (1984) reported that they first began experiments with multisensory resources and small group teaching and began calling observable preferences "learning styles." Dunn, Dunn, and Price (1978) devised the Learning Style Inventory based on their experiments. It is an inventory assessing learning differences which is widely used today. This inventory measures affective and environmental elements which, according to Curry's (1983) classification, is on the observational level, and according

to Keefe (1987) measures the affective and physiological domains.

Price, Dunn, and Sanders (1981) verified through a stepwise discriminate analysis several factors in the Learning Style Inventory that influence reading achievement. In a study on reading achievement and learning style characteristics, Price, Dunn, and Sanders (1981) administered the Learning Style Inventory and determined that selected learning style characteristics can predict students who are likely to become good readers. Dunn (1984) has concluded that since students achieve better when taught through their preferences, their preferences must be their learning strength, meaning that it is easier for them to absorb and retain when their environment is complementary to their preference. Cavanaugh (1981) found that feedback to students on their learning style with their strengths and weaknesses built awareness of the students' own similarities and differences.

A study confirmed for Dunn and Bruno (1985) that under-achievers have learning style characteristics that differ dramatically from those of high-achievers. Learning styles of the gifted/talented were also examined and it was found that these students require unique instructional strategies. Dunn (1984) has concluded that because it has been verified that learning styles of high-achievers and the gifted/talented required different instruction, undoubtedly

the styles of underachievers also require different approaches than those used in the conventional classroom.

Researchers have conducted correlational studies between individual preferences and other influences on learning, and have examined many diverse groups. As a result of the correlational studies, profiles of the styles of a wide range of the learners has been developed (Dunn, Beaudry, and Klavas, 1989).

Knowledge of their own learning style gives students a measure of control over the classroom events. That sense of control is reinforced if the teacher teaches to that style (Jenkins, 1988). Many studies have verified significant learning improvement when the student is taught according to his learning style. Lemmon (1985) noted significant gains on scores on the Iowa Basic Skills Test when students were allowed to take the test in their best style which incorporated time of day, light, formality, and intake as determined by the Learning Style Inventory. Dunn and Dunn (1987) found that it took as little as six weeks to see increased achievement and a decrease in discipline problems when teachers responded to individual learning styles in instruction. Dunn (1983) reported that significantly more positive attitudes result when students' styles are similar to their teachers. Gregorc (1984) found that students learned with ease when the expectations and environmental demands matched their particular systems of thought.

Dunn and Carbo (1981) documented that teaching to perceptual strengths should be from the beginning of the instruction not for remediation, that students recognize their own preferences, and that younger children are more visual and tactile-kinesthetic learners. Although selected elements of learning style seem to parallel achievement, Dunn (1981) postulates that what researchers don't know about learning style may prove to be the connection between effective instruction and academic achievement.

As learning style was explored, cognition and personality influences could not be ignored. Keefe (1987) said that there are characteristic differences in the ways that students prefer to perceive, organize, and retain incoming information. The cognitive styles are the traits of individual personalities. Messick (1976, p. 5) defined cognitive styles as "consistent individual differences in preferred ways of organizing and processing information and experience conceptualized as stable attitudes, preferences, or habitual strategies which determine an individual's typical mode of perceiving." Keefe (1987) credited Allport with coining the term "cognitive style" in 1937 to refer to a quality of living and adapting influenced by distinctive personality types. Most cognitive learning style models are classified in Curry's (1983) information processing level.

Many researchers have devised instruments to test cognitive styles. Kolb (1978), McCarthy (1981), Gregorc

(1984), and Myers (1980) selected personality-related learning variables with characteristic differences from which models of cognitive style were developed. Curry (1983) classified Kolb's (1978) theory of Experiential Learning mainly as an information processing style concept. Kolb's theory addresses personality level individual differences. McCarthy's right brain/left brain concept fits also into the information processing classification. Gregorc's conclusions that dispositions are both natural and learned classifies his theory into Curry's cognitive personality style level. The Jung-based Myers-Briggs concept of type is also classified in the cognitive personality style level.

Kolb (1978) founded his Learning Style Inventory on the Jungian (Jung, 1946) concept of types and on Kolb's own Experiential Learning Theory with roots in Lewin's social psychology and laboratory education work of the 1950s and 1960s. Kolb proposed a cyclical model of experiential learning composed of four stages beginning with concrete experience, followed by observation and reflection, which leads to abstract conceptualization and, finally, to active experimentation in testing of hypotheses in succeeding experiences. Learning style is expressed in the degree to which a person favors a particular stage of the cycle. It is a model depicting growth and development with individuals moving from one stage to another.

Kolb (1978) stated that people resolve the tension between the dimensions in a characteristic manner. Learning abilities are developed as a result of individual heredity and past life experience. Some learning abilities are developed to a higher degree than others. Kolb has provided a framework for conceptualizing individual differences in style of adaptation to the world in his experiential learning model. Kolb's Experiential Learning Theory, like the Jungian theory (Jung, 1946), "is a holistic concept that seeks to describe the emergence of basic life orientations as a function of dialectic tensions between basic modes of relating to the world" (p. 6). Kolb considerd that the central life task of an individual is learning and that human development is an important part of these "dialectic tensions."

McCarthy (1981) developed a system of techniques called 4MAT following the format devised by Kolb (1978). McCarthy added right brain/left brain interpretation to the system. A circular diagram illustrates the movement of the student through the stages to return to the start again. A teacher's role is examined in relation to the student's place in the cycle. The 4MAT system was devised to help teachers become aware of their own and their students' learning styles.

As Gregorc (1984) developed his perspective of learning style, three inferences were drawn. The first was that

dispositions are both natural and learned. The second was that mind sets arise from deeper driving forces. And the third inference was that individuals are predisposed to relate best to certain conditions for personal growth and development. The results of Gregorc's work supports the position that style characteristics are related to systems of thought and to the driving forces of the mind. Gregorc notes that pseudo-styles could be developed by accommodating students that would not have the psychological support systems or the requisite mind qualities to support the students philosophically. The learners who do not accommodate to the preferred style may be labeled learning disabled.

Myers (1980) modified and elaborated upon Jung's (1946) theory of personality types. Myers and McCaulley (1985) defined personality type as the belief that all people use four basic mental functions as defined by Jung to view the world and to perceive and make decisions. Myers (1980) with Briggs developed the Myers-Briggs Type Indicator, a psychometric questionnaire which is a reliable method of determining a person's Jungian type. Myers stated that Jung's types are theoretically pure but not practical and needed elaboration. Myers described well-balanced people as those who have an auxiliary function which helps establish psychological balance. She stated that there are three essentials that extend Jung's theory. One is the

understanding that there is a constant presence of the auxiliary process. Secondly, recognizable characteristics result when the functions of judgment and perception are combined with other functions. Thirdly, the role of the auxiliary is to balance the type by giving access to the opposing function.

Myers (1980) stressed that the middle two letters of the letter set are important for describing how the individual addresses the world. One is the dominant function and the other is the auxiliary function. Myers broke up the letter set in describing various characteristics about types. In one description the letters ST, SF, NT, and NF were used to describe types in different occupations. The SN preference determines what interests people and the TF preference determines the kind of judgment that is easier and more agreeable to use. Other authors used different combinations of Jung's letters and use Jung's type descriptions under different labels to examine different features of personality (Lawrence, 1982; Keirsey and Bates, 1984; Golay, 1982). The Keirsey and Bates interpretation on which this discussion is based will be addressed later. Each preference has an affect on the other preferences and the prevailing attitude. Temperament combines the letters to portray holistic characteristics of a person.

Sharp (1987) indicated that typological analysis can be helpful, but also misleading. The validity of a test is

statistical and time-specific and there is always a possibility of change.

Many studies have used the Myers-Briggs Type Indicator to see if other features of a person would correlate with the Indicator. Arraj and Arraj (1985) examined the hypothesis whether Jung's typology could be correlated with Sheldon's somatotypes or body types. The relationship between the two theories implies that a biochemical and genetic base exists which suggests that certain types have distinctive biochemical traits, i.e. coronary heart disease or diabetes.

The Minnesota Multiphasic Personality Inventory (MMPI) (Myers & McCaulley, 1985) had a significant correlation with the Myers-Briggs Type Indicator (MBTI). Different subtests which measure specific personality traits correlate positively with the MBTI pole that measures the same trait, and correlates negatively with the opposite MBTI pole .

The Myers-Briggs Type Indicator was also used by Leigh (1986) to devised a self-scoring "Job Stick" based on the MBTI. This was a test to determine compatibility of certain types with certain work situations. He stated that his "personality factor" is the influence that personalities have over actions and is a collective part of and individual's being. This assessment, the "Job Stick," was designed only to demonstrate Leigh's "personality factor" and not to replace the MBTI.

Hirsh and Kummerow (1989) based their book, Lifetypes, on Jung's (1946) theory about personality types and on Myers' (Myers, 1980) expansion and elaboration of Jung's theory and subsequent development of the MBTI. Hirsh and Kummerow stressed that not only do people exhibit physical preferences, they also exhibit mental or psychological preferences. The four basic preferences are:

1. energizing- how and where one gets energy.

2. attending- what one pays attention to when gathering information.

3. deciding- what system one uses when deciding.

4. living- what type of life one adopts.

Hirsh and Kummerow (1989) confirmed Jung's and Myers division of two choices for each preference which, when favored, results in psychological type. All eight preferences are available for use, but four of the preferences are more accessible and comfortable to use. Once people understand themselves better, they can gain insight on how other people think and how to get along with them. External influences can cause individuals to use preferences that are less natural to use. Hirsh and Kummerow stressed that all types are worthwhile and equal in value. Type preferences illustrate, but do not limit people to only that style. Since all preferences are available for use, good type development means that people use their natural preferences but know when to stratagize and appropriately

use the opposite preference even though they may not use it equally as well. Each person is unique but a shared pattern exists.

Keirsey and Bates (1984) have combined the theory of Jung's (1946) psychological types, the Myers (1980) method of measuring type, Kretschmer's temperament theory and mythological Greek personalities to create a more global explanation of temperament. The theories of several thinkers of personality have been integrated by Keirsey and Bates in the book Please Understand Me. Keirsey and Bates used Jung's (1946) type descriptions and accept the Myers Briggs Type Indicator (MBTI) as a valid method for classifying types. The usefulness of Jung's classification is recognized, but Keirsey and Bates considered Jung's theory as types emerging by selection of different functions or splitting of characteristics. In this division of characteristics, Jung's theory was considered reductionistic by Keirsey and Bates. In order to unify the characteristics of each function to represent a whole individual, Keirsey and Bates used the MBTI classification of an individual and reclassified the individual into one of the four ancient Greek temperaments. These authors concentrated on explaining differences in people by fitting the sixteen Myers-Briggs types into one of the four temperaments.

Keirsey and Bates (1984) defined temperament as a "moderation or unification of otherwise disparate forces, a

tempering ...of opposing influences, ... a kind of thematization of the whole, a uniformity of the diverse" (p. 27). Keirsey and Bates stated that temperament is a signature of one's actions. Temperament is a characteristic manner in which a person responds to the world. The four original temperaments traced by Keirsey and Bates were described by Hippocrates. Hippocrates named the four temperaments the Phlegmatic, Sanguine, Melancholic, and Choleric. Each temperament had specific behavior characteristics. The ancient Greeks personified these temperaments in four Greek gods. These are Epimetheus, Dionysus, Apollo, and Prometheus. The personification myth created Epimetheus to convey a sense of duty, Dionysus to teach man joy, Apollo to give man a sense of spirit, and Prometheus to give man science. Keirsey and Bates (1984) have incorporated the personification of these four Greek gods to represent metaphorically the temperaments. The authors expanded the notion of type by first identifying the parts of the psychic by means of the MBTI, and then using temperament to unify the otherwise disparate forces

In constructing their descriptions of personified temperaments, Keirsey and Bates (1984) have pulled theoretical contributions from Jung, Kretschmer, Freud, Adler, Sullivan, and Maslow. Others, like Golay (1982), have elaborated on Keirsey and Bates' interpretation. Jung's sensing type (S) seemed similar to Kretschmer's

cyclothymic temperament and the intuitive type (N) seemed similar to Kretschmer's schizothymic temperament according to Keirsey and Bates. In order to fit into the personified temperaments, the Ss, or cycloids, could choose as their preferred approach to the world either the Epimethean duty (social status) temperament or the Dionysian joy (freedom to act) temperament. The Ns, or schizothyms, could choose as their preferred approach to the world either the Apollonean spirituality (self-actualization) temperament or the Promethean science (power) temperament. This unification of functions bonded sensing (S) with only the judging (J) function or the perceptive (P) function, and bonded intuition (N) with only the feeling (F) function or the thinking (T) function. This bonding resulted in the types SJ, SP, NF, and NT.

Keirsey and Bates (1984) then matched Spranger's views of temperament (Economic, Aesthetic, Religious, and Theoretical) to the corresponding type combination of Jung (1946). These views expressed what each temperament valued in life. Keirsey and Bates were able to clearly relate each distinguishing value of Spranger to the types of Jung. They found that the SJ values the Economic (commerce), the SP values the Aesthetic (artistry), the NF values Religiosity (ethics), and the NT values the Theoretical (science). These values added another personality dimension to the temperaments. The theorists who contributed to the Keirsey

and Bates interpretation and their names for corresponding temperaments are listed in Table 2.

TABLE 2

THEORISTS AND THEIR MATCHING NAMES FOR SIMILAR TEMPERAMENTS

Theorist Name	Temperament			
Keirsey and Bates	SJ	SP	NF	NT
Hippocrates	Phlegmatic (phlegm)	Sanguine (blood)	Melancholic (black bile)	Choleric (yellow bile)
Greek Gods	Epimethean (Duty)	Dionysian (Joy)	Apollonian (Spirit)	Promethean (Power)
Sullivan	Social Status			
Freud		Pleasure		
Maslow			Self Actualization	
Adler				Power
Kretschmer	Cyclothymic (choose either duty or joy)		Schizothymic (choose either spirit or power)	
Spranger	Economical (commerce)	Aesthetic (artistry)	Religious (ethics)	Theoretical (science)
Golay*	Actual Routine (belong)	Actual Spontaneous (free)	Conceptual Global (becoming)	Conceptual Specific (competent)

(References from Keirsey & Bates, 1984)
(*Golay, 1982)

Each temperament has a learning style through which each individual processes information best (Myers, 1980). Myers (1980), McCaulley (1987), Keirsey and Bates (1984), Lawrence (1982), and Golay (1982) all defined learning style characteristics to the Jung letter-types. Keirsey and Bates used the above combined characteristics to fit the Jung letter-types of SJ, SP, NF, and NT. In her book, Gifts Differing, Myers (1980) listed learning styles of difference preferences. Intuitives have an advantage on verbal or timed ability tests because they can readily translate words into meanings. Sensing students have a disadvantage on these kinds of tests because they do not trust their intuition enough to get the meaning of words at first glance. Speed in taking the tests is important. When the demand for speed on a test is decreased, important improvement in results can be produced for the sensing students.

The last letter of the type formula, J or P, shows whether the outer world is dealt with in the judging or the perceptive attitude. Myers (1980) defined judging as including the processes of coming to conclusions about what has been perceived. The term perception is defined as including the processes of becoming aware of things, people, occurrences and ideas. Judging can be accomplished through thinking (logical process), or feeling (appreciation). Perceiving can be either through sensing or through

intuition. A majority of sensing students are J. If they have the strengths of the judging type, they meet their deadlines and finish what they begin.

Myers (1980) saw the utility in recognizing types when she said, "The type concepts are thus useful whenever one person must communicate with another or live with another or make decisions that affect another's life" (p. 25).

McCaulley (1987) emphasized the practical application of Jung's (1946) theory to the teaching of problem-solving and strategies that develop skills in perception and judgment. Individuals can be taught to understand their own behavior and become more conscious of the way they direct their lives. In problem-solving, people use their strongest mental process as a first step. The four mental processes direct conscious activity toward different goals. McCaulley suggested that the model using all four mental processes, Sensing (S), Intuition (N), Thinking (T), and Feeling (F) teaches students to be aware of how other people think and that all mental processes are of value. The use of all four processes achieves the best decision. Myers (1980) believed that if students can follow each step of the problem-solving process using S, N, T, and F to see each side of the problem, they will be more flexible and gain more command of their mental powers and become more effective decision makers and more effective in all aspects of their lives. Both Myers (1980) and McCaulley (1987) recognized that a

sounder decision can be made based on facts (S), possibilities (N), consequences (T), and human values (F).

Lawrence (1982) in his book, People Types and Tiger Stripes, called preferences mental habits and they are as hard to change as it is to try to change the stripes on a tiger. When he applied type theory to education, Lawrence noted that each type is the motivation pattern of each student. In his work with student motivation and learning style, Lawrence has determined that type is fundamental in explaining why some instructional approaches work better with some students than with others. Lawrence recognized that there are type biases in school expectations and procedures. The most essential relationship between type and learning style is indicated by the nature of the dominant mental process in each personality. Lawrence stated that the optimal learning can take place if thinking types are allowed to use logical order, feeling types are allowed to follow their hearts, sensing types are allowed to strive to engage senses, and intuitive types are allowed to follow whatever inspires them. Similar types understand each other better. Insecure students can be supported by teachers of similar type. More secure students need a balance of a challenging different type of teacher.

Motivation, according to Lawrence (1982), can be broken down into four parts corresponding to the four dimensions of type. Natural interests are indicated by the extraversion-

introversion preference. Extraverted people are focused outward, continuously scanning the environment for interesting events which they approach on a trial and error basis. Introverted people are focused inward to reflect on fewer interests more deeply.

Basic learning style difference is revealed by the sensing-intuition preference. Sensing students respond to step by step, literal, concrete experiences. Intuitive students respond to experiences that stimulate the imagination. They jump from topic to topic as they search for patterns, possibilities, and global ideas.

The thinking-feeling preference indicates patterns of commitments and values. The thinking type of student commits to situations that respond to logical analysis while the feeling type of student commits to situations where human factors are involved.

The work habits of a student are shown by the judging-perceiving perception. The student with a judging attitude prefers a clear-cut plan with a definite closure. The student with a perceiving attitude resists closure because he wants new data and may postpone decisions because he does not feel like a project is complete. The perceiving student usually has a last-minute rush to meet deadlines.

Lawrence (1982) stated that American education has harmed ES (Extraverted Sensory) children because of bias of instruction. Both textbooks and standardized tests are

written by intuitive writers. The intuitive way of viewing the world is reflected in the way the books and tests are written. Lawrence stated that "The record of American education in the 20th century is a record of neglect of sensing intelligence...the kind of intelligence possess by the majority of American students" (p. 43).

Golay (1982) renamed Keirsey and Bates' (1984) terms. Golay pointed out that aspects of personality can be identified but can be limited in usefulness by only knowing a part of the whole. Once the whole temperament is identified, the particular aspect can readily be discerned within the whole. Golay also stated that one must appeal to the natural way of being in order to get a student to be responsible for his own learning. Teaching plans can be developed to address the manner which appeals to a student who does not prefer the subject. As the teacher begins to perceive students as having certain personality types and learning patterns, Golay contended that the teacher will no longer expect all students to be responsive to the same educational program. Golay theorized that the teacher will not attempt to teach individuals. Instead, Golay said the teacher will teach to the four existing groups and patterns.

Race

In examining the Minnesota Multiphasic Personality Inventory (MMPI) for racial bias, Dahlstrom, Lachar, and

Dahlstrom (1986, p. 200) found that the MMPI studies had no universal ethnic or "black" characteristics which differentiated black people from white people. The MMPI studies pointed out that individuals who experience "multiple disadvantages of limited education, low income, lack of occupational skills or training, and the barriers and exclusions associated with minority ethnic status" have special adaptive difficulties (p. 200). The black people who have the higher educational status, have better occupational skills, and earn equitable incomes have similar responses as similar white comparison groups on the MMPI. Dahlstrom, Lachar, and Dahlstrom (1986, p. 201) found that a "black personality" was not justified by the characteristics found in the black samples of educated, upper socioeconomic groups.

The MMPI has examined many different background characteristics of samples and Dahlstrom, Lachar, and Dahlstrom (1986) found that when black and white samples had backgrounds a similar as possible, the usual differences that others had reported on black and white groups was not found or no more than can be expected from chance. MBTI continuous scores have been correlated with many similar scales to establish that similar constructs are being evaluated. The MMPI was one of the instruments which indicated significant correlation with the MBTI (Myers and McCaulley, 1985). Myers and McCaulley reported that a

cross-cultural hypothesis was tested and confirmed Jung's idea that type differences should be consistent across cultures.

Banks (1988) recognized that low academic achievement for minorities was a complex problem. The first explanation of low minority academic achievement that emerged was cultural deprivation. After the cultural deprivation notion was harshly attacked and rejected, the concept that a different set of assumptions affected learning of minorities as well as differences in cognitive, learning, and motivational styles. The cultural differences paradigm was helpful, but social class diversity has been presumed to be the most important variable and generated a social class hypothesis. Banks (1988) examined research on cognitive styles, learning styles, and motivational styles with social class as a variable. In general, Banks' report of research indicated that social class strongly influences styles of thinking, locus of control, internality, intelligence test performance, and mental abilities. However, Banks (1988) stated that the studies reviewed provided more support for the cultural difference hypothesis than for the social-class hypothesis. Banks concluded that even with a middle class background, ethnicity continues to significantly influence the learning behavior and styles of Afro-American and Mexican-American students. Ethnicity persists throughout social mobility.

Ogbu (1987) concluded from his studies that some minority groups do well in school even if the language and cultural backgrounds of the dominant group are not shared. One observation was that sometimes the groups who differ the most from the dominant group do well in school. Another observation was if an involuntary minority group emigrated to a country where there was more difference between the original culture and language, the students performed better. Social adjustment and academic learning problems are initially experienced by all minority children. Ogbu (1987) stated that the main differentiating factor between successful and unsuccessful minorities appears to be the nature of the history, subordination, and exploitation of the minorities, and the nature of the minorities' instrumental and expressive responses to their treatment, which affects the process of schooling. Involuntary minorities have a tendency to equate school learning with the learning of white American cultural frame of reference. Success is equated with acting like a white person. Adopting the school's attitude threatens the involuntary minorities' language, culture, and identity.

Erickson (1987) found weaknesses in Ogbu's explanations and said that Ogbu's (1987) theory implied that neither student nor teacher could do anything positive together educationally. Erickson said that learning what is deliberately taught involves assent to the exercise of

authority which trusts that authority will be benign. It is essential that student and teacher risk, establish, and maintain trust in each other.

Erickson (1987) promoted a culturally responsive pedagogy as one means of helping students succeed. His thesis emphasized that both the verbal and the nonverbal communication styles which have been culturally learned contribute to the high rates of school failure by students of low socioeconomic status and minority ethnic and cultural backgrounds. A miscommunication in the classroom occurs because of cultural differences in speaking and listening. Erickson found that a culturally responsive pedagogy resulted in higher school achievement and morale than was typical of Native Americans and black students.

Femminella (1979) traced the history of American schools and stated that because the Anglo-Saxon culture dominated the formation of schools, schools became a tool to eliminate ethnicity and Anglo-Saxon cognitive styles should be adopted. Hale-Benson (1986) also stated that the educational process in America has been designed for Anglo-Saxon middle class children. She felt that intelligence tests are distorted for measuring black children, and the emphasis in the system is to mold black children so they will fit the system. Black behavior has been the emphasis of analysis and not interactions between two different cultures.

Hale-Benson found that black cultural membership has an effect on a wide range of behavior.

Femminella (1979) addressed how alternative cognitive styles are being destroyed in American schools. Cultural cognitive skills which have been transmitted from generation to generation are being lost because, Femminella stated, schools are insisting that Anglo norms of education, behavior, methods of learning, and methods of expressing oneself be used. Femminella stressed that an ethnic awareness needs to exist in the teaching of subjects.

Ramirez (1982) argued that individual differences can be educationally meaningful and not the forced situation that Hale-Benson (1986), Ogbu (1987), and Femminella (1979) have noted. Ramirez listed typical minority characteristics in approaches to learning and states that the public school does not tend to teach to those types of preferences. Cognitive styles research can be responsive to diversity within cultures as well as between cultures so stereotyping will not occur. Ramirez (1982) also focused on the family socialization of the child as an influence on learning preferences.

Aptitude-Treatment-Interaction (ATI) of many studies have been examined by Cronbach and Snow (1977). Cronbach and Snow (1977, p. 6) defined aptitude as "any characteristic of a person that forecasts his probability of success under a given treatment." They defined treatment as "any

manipulable variable." If opportunities are provided for people who demonstrate excellent aptitudes other than the traditional verbal-scholastic one, society has a great potential resource in its people (Cronbach and Snow (1977, p.9). Educational methods in the traditional school are geared to verbal-academic accomplishments. Non-conventional students are usually not high in verbal ability and educational programs need to be designed to fit these students. Enough treatments should be designed so that everyone will be able to succeed in one of them, and to choose the right participants for the right treatment. Cronbach and Snow (p. 513) stated that "aptitudes influence response to treatment because learners act differently upon material." When single traits have been studied, some significant variables have been identified that cause interactive main effects in personality styles and learning. However, much of the students' response to instruction cannot be accounted for by a single trait (Cronbach and Snow, 1977).

Femminella (1979) stated that an individual's value system determines that individual's best learning style. Since black socialization has been considered important in learning, Beady and Slavin (1980) developed an alternative grading structure called the Individual Learning Expectations or ILE. They found blacks performed better in cooperative situations with recognition tied to performance.

Terrell and Terrell (1981) found that giving culturally relevant social reinforcement to mildly retarded black males produced significantly higher scores than other reinforcements.

Shade (1984) stated that the preferred learning modality of the majority culture was visual and the preferred learning modality of the black minority culture was kinetic and tactile. Black Americans have been taught to perceive and to transform the world visually through the senses. Shade (1979) noted that the socialized difference of selection of the appropriate adapting strategy best explained the difference in cognitive style of black people.

Emihovich and Miller (1988) noted that as computers become more available for instruction, the relationship of minority students' learning styles must be considered. Emihovich and Miller agreed with the literature that indicated learning is mediated through social and cultural contexts. Emihovich and Miller stated that computer programming may be beneficial to minority children because of the sense of mastery over environment that is provided. Programming experience also provides a way for minority children to use metacognitive (thinking about thinking) skills that they will need for future learning.

The idea is presented that a multicultural philosophy must exist in a school with a high multiethnic student body and pervade teaching so that values, history, culture, and

special holidays are not denied to other ethnic groups (Kehoe, 1983). Kehoe discussed the hidden curriculum of teaching norms and values to students. Conventional practices are assumed by the majority to be proper but may be entirely improper for other cultural groups. The clientele of many urban schools has been dramatically altered by the changing demographic patterns but little or no effort has been made to fit the school program to the minority student.

Curriculum differentiation studies were examined and found that teachers' perception of the students' social class was translated into differentiation of curriculum in the classroom (Page, 1987). An educational hierarchy existed with the teachers of the lower-track students perceiving their role as caretakers instead of teachers and did not respond to individual needs of students.

Ramirez (1979) hypothesized that future leaders in a culturally diverse environment will need to develop interethnic skills. Schools historically reflect a North American/Western Europe world view and has tried and is still trying to assimilate minority members into this world view. Ramirez (1979) formulated a Conflict/Replacement category for social acculturation models. Three assumptions of the models are (a) that a conflict is created for persons who participate in more than one sociocultural group, (b) problems of adjustment result from the conflicts, and (c)

persons must reject the minority culture and embrace the mainstream American middle-class to achieve happiness. Ramirez stressed that training in interethnic leadership skills will lead to less alienation, that it is important to foster early socialization and good parental and teacher attitudes toward diversity in people, and that ethnic interaction while maintaining close original group ties is crucial for multicultural orientation.

Demographic Trends

Hodgkinson (1988a) stated that demographic projections are regarded as one of the better predictors of future demographics. If a majority of elementary children are minority today, a prediction of a majority of minority adults can be made for twenty years in the future. Hodgkinson examined demographic projections in terms of five major concepts: fertility, age, region, race, and immigration. These factors will be considered in light of how they will impact education.

The major demographic trends that were mentioned in Chapter I were fertility and immigration trends, aging trends, a trend toward more minority middle class, and a lifelong learning trend (Hodgkinson, 1986, 1987, 1988a; 1988b). These trends can be translated in terms of a student profile. The schools will have more minority students, more poor, physically and emotionally handicapped

students, more minority students who will succeed academically as they become more middle class, less financial base because money will be going to the care of elderly, and more adult learners. Since poverty is a much better predictor of student performance than is race, many students will not do as well academically and the prediction is that there will not be as many high school graduates as there are today (Hodgkinson, 1988b).

Fertility

The western hemisphere had 30 percent of the world's population in 1900s and is predicted to have 9 percent in the year 2010 (Hodgkinson, 1987). The developing nations are having more children. Stability of population depends on each woman having 2.1 children, two to replace the mother and father and .1 to cover infant mortality. White American women are having 1.7 children according to the census. Hispanics and blacks are maintaining the rate of childbearing.

Another one of the trends that is indicated by a demographic study of the 1980 Census (Hodgkinson, 1986) is that the dominant background of Americans will be non-European by the 21st century. An impact of differing cultures is already beginning to show in the educational system. In the 21st century the Asian and Third World

traditions and values will be more relevant in the evolving American culture.

The businesses of today are already creating educational divisions to educate their workers. Some have created diploma-granting colleges in cooperation with local universities. The businesses are involved in contributing resources to education but not money.

These trends support the notion that schools will become more culturally diversified. Curriculum changes will need to occur to encompass the many cultural traditions. Extended education will be able to be obtained from many other sources.

Age

America is rapidly becoming a nation of older people with more people over 65 than there are teenagers (Hodgkinson, 1986). The Baby Boomers will start to retire shortly after the year 2000. The work force that will support the older group will be much smaller than it is today. Education will be affected because of a struggle for financial support between the dependent young who need expensive educational services and the dependent elderly who require expensive medical services (Hodgkinson, 1988b).

Region

The regions affected by high birth rate with 73 percent

increase are localized in only five states: Texas, California, Florida, North Carolina, and Arizona (Hodgkinson, 1986). All of these states have a very large minority birthrate. America's population is growing as the population moves to the Sunbelt and the gain is from minority fertility and immigration. These are some of the areas mentioned by Hodgkinson (1988b) that had a low retention rate for high school students.

Another trend which will affect the size of schools and number of students to be educated is the growth of metropolitan areas (Hodgkinson, 1988b). Work areas that extend across state lines like Boston to Washington D. C. affect retention rates in high schools. Even with the growth in the Southern United States, the regional values and populations are the ones that dominate the American culture.

Race and Immigration

Racial characteristics of population are important to consider and immigration must be considered at the same time. The major way minorities are increasing in the United States is through immigration. Hodgkinson (1988) predicted a high influx of minorities to continue for the next few years. Another fact to note is a large increase in black and Hispanic middle classes, because children from these homes perform like white middle class children. Hodgkinson (1988) speculated that the increased wealth in non-white

groups may lower birth rates. Academic performance of minorities will increase.

Since there has essentially been no major change in the secondary school curriculum for two decades, and major funding and control has been removed from the local boards, the future curriculum will be hard to change. As education over the past few decades was examined, adult control over youth has been obvious in the classroom. Hodgkinson (1987) demographically pointed out that since adult Baby Boomers are in the majority, they are reasserting control over a small generation of youth as a tool for socialization. Hodgkinson predicted that as long as these adults exert influence, the curriculum is unlikely to change. Hodgkinson (1987) believed that the American public school curriculum is essentially European in nature. With the diversity of cultures that are impacting the school, the curriculum needs to become more relevant and effective for the projected 40 percent minority youth of the year 2000. Hodgkinson (1987) stressed that educators need to plan for the kind of student that will be attending school in the next two generations.

Hodgkinson (1987) stated that even though European history and traditions have been relevant in the past, the history, traditions and values of Asia and the Third World are becoming more relevant to evolving American culture.

Schools will be not only the institutions to change. The census shows that more minorities are moving into

positions of political power and wealth. As the minorities become more middle class, the schools will be positively affected. Studies have shown that middle class minorities perform as well as middle class white (Hodgkinson, 1988b; Dahlstrom, Lachar, and Dahlstrom, 1986).

Integrated Learning System

Technology- Integrated Learning System

Schools are faced with growing concerns over educational effectiveness, efficiency, and productivity and are turning to educational technology as a strategy to improve education. The impact of the computer in the classroom has become a major strategy that the schools are using. Discussion over how to utilize the computer has programmers designing appropriate learning software. One such program is the Integrated Learning System--a complete unit of lessons with built-in placement, remediation, testing, and record-keeping capabilities (Komoski, 1987). Bracey (1991, p. 16) defined an ILS as an "increasingly popular but often expensive hardware/software system with numerous student computers networked to a central computer that has curriculum software and a management system to track student performance.

Komoski (1987) stated that the teacher should still retain control over the progress of the student and be

allowed through an authoring system to adapt the ILS to student needs. The ILS is structured in curriculum purpose and content, instructional strategy and tactics, teacher and student roles, the amount and nature of teacher and student control of the system, and how student learning is to be assessed.

Balajthy (1988) and McCarthy (1989) defined an integrated learning system in different ways. Balajthy saw it as a computer-based instructional system including both hardware and software. McCarthy (1989, p. 31) defined integrated learning systems as "comprehensive packages of computer-based instruction that focus on basic skills. The components include hardware, courseware, and an instructional management system." McCarthy said the defining feature of an ILS network is its closed architecture. True networks defining characteristic is open architecture--it will run any program compatible with the file server if written in networkable form. Balajthy distinguished the Integrated Learning System (ILS) from a microcomputer in that in the ILS the component workstations are connected to a central computer or memory storage device which allows students to receive individualized lessons from the program. As the students respond to the lessons, a comprehensive management system tracks progress. One researcher perceives the ILS as a open-ended, many-programmed technical tool and the other researcher sees the ILS as a closed, intact unit

of instruction. The use will depend on the programmer and on the teacher who uses the program.

Balajthy (1986) reported that one issue to consider in improved learning is the Hawthorne effect which is new and innovative teaching techniques may be effective because of the variety offered to the student. After the students become accustomed to the new technique, the positive effect will be reduced.

Integrated Instructional System software has typically traditional Computer-Assisted Instruction (CAI), but the unique feature is that it also has a management system for tracking student progress. The systems feature diagnostic assessment, prescriptive lessons, teacher adjustment of lessons, and posttests. Each phase is then able to be printed out for a hard copy of each student's progress (Balajthy, 1988).

Consistent findings in literature stress that Computer Assisted Instruction (CAI) improves upon or is equal to the amount of learning from nonelectronic approaches, CAI teaches children faster, and CAI interaction improves student attitudes (Balajthy, 1986; Komoski, 1987; Rowland & Stuessy, 1988).

Rowland and Stuessy (1988) stated that even though CAI programs are branching to accommodate individual responses, there are few programs that address individual differences in learning or cognitive style. These

researchers felt that some learners with one type of learning style might not learn from one or the other of the modes of CAI. They examined two types of learning/cognitive styles, the holist (global thinkers) and the serialist (linear sequential thinkers) and two types of CAI, tutorials and simulations. Rowland and Stuessy concluded that cognitive style does interact with CAI to affect student achievement. The learners are more effective if they are matched to the appropriate mode of CAI.

However, Allen and Merrill (1985, p. 3) stated that the findings of research in cognitive psychology shows "that the success of an instructional system depends on how learners process subject matter displays." These authors also said that if students do possess the appropriate processing skills, supplemental instruction assigned by the system may be used to provide extra external support.

Allen and Merrill (1985) pointed out that most computer instruction depends on external instructional stimuli and the analysis of how a student responds to the stimuli. How a student applies learning strategies creates the learning and not the response to the computer. These authors suggested that an instructional system should guide the learner to use previously acquired internal processing strategies in order to become an expert learner. An inept student needs much more external support until learning strategies have been developed, then less support and

control needs to be provided. Students must bring some prior processing skills to the learning environment. Without prior skills, students cannot profit from instructional interventions using system-assigned learning strategies.

System-assignment of learning strategies is difficult when differences in cognitive style are considered. Cronbach and Snow (1977) noted that when individual learning differences are addressed, many alternative external presentations must be generated. Rigney (1978) recommended two displays for the learner; one with the content and one with the selection of learning strategies to use. The processing directions could be individualized for the cognitive style of the learner. Allen and Merrill (1985) believed that system-assignment of learning strategies represents a way for learners to be weaned from instructional support and free them to become independent learners.

Balajthy (1986) also stressed that the teacher cannot be replaced by the computer because significant teacher involvement is necessary. Mageau (1992) found that the studies of Henry Becker (1990), a leading researcher on ILSes, revealed that teachers who were more involved with the ILS work of their students were most likely observe the greatest learning gains. Decisions made in the classroom based on what the students were doing in the lab had the

greatest impact on learning. Mageau (1992) found that teachers struggle to integrate the comprehensive courseware of the integrated learning system into their daily classroom teaching. Of the several integrated learning systems reviewed, Balajthy (1988) noted that authoring programs enhanced the teacher's ability to adapt lessons to their curriculum. Some characteristic problems exist with integrated learning systems. Two of these problems are that there is only one lesson per skill, and that the student attention span is limited because the presentation format is too much the same. Positive features include minimal training time for teachers, minimal student supervision, and independent student functioning.

Bracey (1991) reported that the studies of several integrated learning systems were inconclusive and contradictory. There were four studies found on the Jostens Basic Learning System, two of which found substantial positive effects. Bracey also noted that standardized tests weakened ILS evaluations. The tests do not reflect new developments and innovations in curriculum.

Although research designs and studies have not led to significant conclusions about the ILS, schools are reporting success with ILSes. The La Joya, Texas, Independent School District has the population described by Hodgkinson (1988). The school consists of a large economically disadvantaged minority group who speak English as a second language

(Dervarics, 1991). Approximately 600 new students who are recent immigrants are enrolled each year. Most of these new students are children of migrant laborers and move frequently. This school's use of an integrated learning system has helped to establish individualized learning plans for a fluxuating student body. National test scores have also improved. The children attend school in Washington during that harvest season. Three school districts who use the same integrated learning system cooperate by exchanging reports on students. The students can pick up where they left off from school to school. Concern, effort, planning and cooperation and an integrated learning system have helped students succeed.

Mageau (1992) stated that the philosophy of the school is important. A Rocky Ford, Colorado school has an outcome-based curriculum for which students must achieve mastery goals. An ILS is consistant with outcome-based education. The ILS should be correlated to the school system's curriculum and integrated into the classroom by the teacher.

Jostens Integrated Learning System

The treatment computer system selected for this study is the Jostens Learning Corporation's (JLC) Integrated Learning System (ILS). Jostens ILS uses CD-ROM technology, which allows more rapid access to information and ease of periodic updating the curriculum. All instructional levels

are individualized. The management system includes a variety of reports such as lesson results and test results in individual, group, or class reports. The management system also measures time on task. The main strength of the Jostens ILS is the curriculum software although the Jostens ILS does not have an authoring system (Jostens Learning Corporation, 1989).

Positive gains in achievement have been noted with the use of the Jostens ILS. In a 1987-88 research study, Hurst Hills Elementary in Hurst Hills, Texas, gained one full year's growth through use of the Integrated Learning System. Another study in a school in Victoria, Texas, indicated significant gains in achievement. In Little Rock, Arkansas during the 1987-88 school year, students using the ILS math program gained two months growth for every month in the project. The student using the ILS reading program gained 1.6 months for every month in the project (Jostens Learning Corporation, 1989). The effects of race and learning style on achievement were investigated in this study.

The JLC system will operate on the hardware configurations of the Apple computer, the IBM computer, or the Tandy Corporation computer. The experimental computer lab in this study used the Tandy Corporation computer. All configurations included high resolution color graphics, CD-ROM technology, digitized speech, a mouse and the capability to record and playback the student's own voice. A time-

controlled management system made it possible to serve many lab periods per day in an organized manner. The ILS can be programmed to use either time-controlled schedule or students can use a log-in procedure. The lab is an open system and the hardware can be used for other compatible software. (Twiss, 1989).

The CAI software must meet certain specifications. The Jostens (1989) curriculum has been designed to correlate to the school district's curriculum. The JLC curriculum is correlated to all basal textbooks and to the standardized achievement tests. The format of the curriculum was designed to be developmental and sequential to provide consistency of instruction. Regular updates of the CD-Rom provide opportunities to refine and expand the curriculum. Incorporated into the design of the JLC curriculum were problem solving and higher-order thinking skills.

The CAI management system meets certain specifications, also. The students are placed at the appropriate level based on results from the on-line adaptive test called the Basic Skills Inventory. The CAI software provides immediate feedback, which varies depending on the instructional strategy used in the lesson. The ILS program provides branching, which is transparent to the user unless it is dependent on the user's choice. Branching is also based on the instructional strategy being used in the lesson. Depending upon the student's performance, the lesson

branches to either remedial or enrichment work. The teacher is still an important component in the learning process. The teacher makes the judgment about student performance and makes the decision to move the student up or down in the curriculum (Jostens Learning Corporation, 1989).

The philosophy of Jostens (1989) math instruction is that cognitive development proceeds from concrete and iconic processes to abstract. The progression is associated with chronological maturation. This philosophy is associated with effective acquisition of new learning. The curriculum is designed to bridge the common gap between activity-based, manipulative instruction at the preprimary and primary levels and symbolic textbook instruction.

The mathematics curriculum developed by Jostens (1989) is developmental and sequential. The curriculum balances knowledge, operational skills, and applications throughout each lesson. The emphasis is on higher-order thinking skills and problem solving incorporated into the curriculum. The levels of mental processing addressed by the parts of the units are recognition and recall, use of routine procedures, and concept integration and transfer. Each unit has been designed with goals and subgoals and each lesson in the curriculum emphasizes application to real-world skills.

Several strategies are incorporated into the math curriculum. One is to "guess and test" in which the students make a guess, check the guess via feedback, then

try again. A second strategy is to make a list. The student lists all possible answers, then uses clues to narrow the list to find the correct answer. The substitution of simpler numbers in order to choose the operations that solve the problem is a third strategy. "Find a pattern" is a fourth strategy in which the student discovers the pattern when it is likely that a relationship between numbers or shapes is repeated. The fifth strategy employs the use of drawing a picture or diagram to illustrate the problem to see relationships between elements. The last strategy used in the Jostens ILS math curriculum is for the student to work backward from the end result to find the input (Jostens Learning Corporation, 1989).

In the reading curriculum, instruction is presented in a multiple mode which keeps the learner actively involved. Jostens (1989) uses the events of instruction devised by Gagne' (1977) as the curriculum was developed for each lesson. There are five lesson components. Each lesson has a warm-up, a checkup on prerequisites, a discovery-developmental stage, an exploration stage, and a quiz for feedback. Hypervoice and Hypertext are used and alternative learning pathways are provided. The phonics method is used for teaching reading.

Several strategies are employed. There are several different types of writing style that are included in the

reading selections. The SQ3R strategy is taught, which teaches the student to survey, question, read, recite, and review the material. Comprehension strategies are taught and ways to organize information skills must be taught. These organizational skills are story mapping, concept mapping, summarizing, and outlining. The reading strategy components are to (1) activate prior knowledge, (2) identify vocabulary, (3) set the purpose, (4) monitor the progress, (5) summarize, (6) present a schematic representation, and (7) to promote higher-order thinking skills. Bloom's (1956) hierarchical order of learning (knowledge, comprehension, analysis, synthesis, and evaluation) is utilized with mastery desired as a goal but remediation provided. Study skills are also emphasized. The whole language approach is used (Jostens Learning Corporation, 1989).

Technology is pulling education into the future. Our citizens of tomorrow will use computer technology and the skills which they learn in the classroom. By combining the learning of skills with the use of the computer, two purposes are being served--computer literacy along with teaching essential basic skills.

CHAPTER III

METHODS

This chapter provides a review of the methods and procedures that were used in this study. The chapter has been divided into the following sections: description of research methodology, research design, selection of subjects, instrumentation, classroom procedures, data collection and recording, data processing and statistical analysis, methodological assumptions, limitations, restatement of hypotheses, and summary.

Description of Research Methodology

This research was classified as quasi-experimental because the public school setting does not allow control or manipulation over all relevant variables.

Research Design

Pedhazur (1982, p. 317) helped to establish selection of the population by stating "When the aim is to study the relation between a categorical and a continuous variable in a defined population, it is essential that the categories or subgroups that comprise the categorical variable be represented in accordance with their proportions in the

population." The groups of subjects were used as they are assigned to classes without contriving matched numbers of race or learning style. The variables are represented in the proportion with which they naturally fall in the high school demographics.

Two 2 x 2 x 3 ANCOVA analyses were used to examine the data produced from this study. The Integrated Learning System (ILS) was the treatment for the experimental group. The control group was not given this treatment. The dependent variable in each ANCOVA was the respective posttest (math or reading). The two independent variables were race (black and white), and psychological type/learning style (four types based on the Myers-Briggs Type Inventory and interpreted by Keirsey and Bates (1984)). Because of the high student mortality, two of the learning styles were collapsed into one variable for the ANCOVA analysis. The pretests for both reading and math were covaried on their respective posttests to compensate for initial differences. These scores were used in six cells for the experimental group and six cells for the control group for analysis for both reading and math in an ANCOVA matrix. Table 3 is the configuration for the ANCOVA matrix.

TABLE 3

ANCOVA 2 X 2 X 3 CONFIGURATION

		SJ 1	SP 2	NF/NT 3
READING CONTROL	B			
	W			
READING ILS	B			
	W			

		SJ 1	SP 2	NF/NT 3
MATH CONTROL	B			
	W			
MATH ILS	B			
	W			

The ANCOVA is a factorial design and has several advantages. One advantage is that the independent variables interact directly with the dependent variable. The design gives greater control to the researcher and generates more efficient generalizations than a regression design (Pedhazur, 1982). Pedhazur observed, though, that multiple regression is a superior method of analysis if the cell frequencies in a factorial design are unequal and disproportionate. The high student mortality left the cell frequencies in such a manner. A multiple regression was the second statistical analysis performed on the data.

Both the ANCOVA and the multiple regression deal with classificatory variables. The introduction of classificatory variables in a study is for the purpose of controlling extraneous variables. The variance that might be caused by these factors can be isolated (Pedhazur, 1982). Possible alternative explanations regarding findings about effects or interactions may be ascertained by considering variables associated with the classificatory variables.

The logic of Analysis of Covariance, Pedhazur(1982) stated, is that several variables influence results and that the combination of variables can be taken apart or residualized to determine what part of the variance is caused by a particular variable.

Each variable contributes its part to influence the dependent variable. The portion of variance of one variable

can be taken out of other variables in order to observe the results of the dependent variable in light of the remaining variables. Pedhazur (1982) stated that sometimes if the F ratio is not significant, separating the variance of extraneous variables from the Error term will result in a smaller error and a larger F ratio. In this study, the dependent variable was, in one analysis, the math posttest, and in the other analysis, the reading posttest. The pretest of each test was covaried on the posttest to adjust scores for difference in preknowledge of the respective subjects. The indication of whether the groups differ significantly after their scores have been adjusted for preknowledge differences lies in the test of significance.

Selection of Subjects

Subjects for this study were selected from the students who attended two mid-western, urban high schools. The students selected for the reading portion of the study were in ninth grade. The experimental school had all ninth graders in a required class called Academic Study Skills which rotated every nine weeks to different topics (Self Esteem, Computers, Study Skills and Reading). One nine-week period was a reading skills section which was the experimental section in this study. This high school had a computer lab which ran the Integrated Learning System. The

comparable classes in the control school to the Academic Study Skills classes were the ninth grade English classes.

The students selected for the math portion of the study were in general math classes or personal math classes regardless of school classification. The experimental school math classes utilized the Integrated Learning System throughout the school year in addition to regular classwork. The control school taught regular math classes.

Both schools had administrators and teachers committed to helping students succeed. The treatment school had a higher black student ratio than the control school and motivational programs had been started to promote thinking about college and succeeding in school. After-school tutoring was available on an application basis. A promotion for pride in academics was started by giving the calculus class members T-shirts and by involving the Honor Society in many student activities.

The control school had motivating extra-curricular events for students' participation. Classes began and ended without the usual bells heard in most schools. Students were given the responsibility for being on time to class. Hallways were quiet and mostly free from students during class time.

The original anticipation of 400 to 600 students participating was raised to a total of 960. Some subject mortality was expected because of student transfers,

dropouts, or failure to take one of the tests. At the experimental school, 608 of the students received the treatment of the computer-based Integrated Learning System during the year. At the control school, about 300 of the students were in the control group. Some students had both a reading and math score if they were in both types of classes. Some students had either a reading or a math score if they were in only one type of class.

Voluntary data was needed from school records to establish population homogeneity. The math grade and the reading/language grade earned from the previous grade helped establish capability of the student. National testing scores for both reading and math tests established a standard base for interpreting scores. Anonymity was assured by the use of student identification numbers to prevent disclosure of confidential information. Population homogeneity was established to reduce the confounding of variables and promote chances for a clear interpretation of data.

A serious threat to internal validity of any study is subject mortality. Pedhazur (1982) commented that subject mortality may occur for a myriad of reasons from simple to complex. Subject mortality may also cause groups of different people to form by a process of self-selection. The researcher may consider if the results are due to the treatment effects or because of the differences among

subjects in the different treatment conditions. Unequal numbers of subjects often is the result of subject mortality. Pedhazur felt that the general population should be proportional to the sample population.

One process Pedhazur (1982) found of self-selection was nonresponse. Various techniques have been devised by sampling experts to adjust the results for such occurrences.

Instrumentation

The Myers-Briggs Type Inventory (MBTI) was the instrument used to determine psychological type/learning style. The reading pretest and posttest were the Gates-MacGinitie Reading Tests, Second Edition, Level E, 1978. The Stanford Diagnostic Mathematics Test (SDMT), 3rd Edition, Blue Level, Form G. 1985 was used for the math pretest and posttest.

Reliability of the Gates-MacGinitie Reading Tests

Excellent reliability is reported for all levels of the Gates-MacGinitie Reading Tests (Stahl, 1895). The Kuder-Richardson Formula 20 reliability coefficients were computed from the standardization sample for each level of the teat. The reported coefficients for grade level 9.1 for test level E and form 1 for vocabulary and comprehension were 92 and 91 respectively. The reported coefficients for

grade level 9.8 for test level E and form 2 for vocabulary and comprehension were 92 and 91 respectively.

Validity

The Gates-MacGinitie Reading tests measure important knowledge and skills that are common to most school reading curricula. Both vocabulary and comprehension were tested since research has shown that these two components represent different abilities. Several word lists were selected to compile vocabulary words. All vocabulary words were real words and checked against dictionary entries for correctness.

Reliability of the Stanford Diagnostic Mathematics Test

The Kuder-Richardson Formula 20 was used to determine the internal consistency reliability of SDMT scores. The reliability coefficients for form G of the fall testing of the applications test for the various grades tested are: grade 9, .89; grade 10, .87; grade 11, .88; and grade 12, .87.

Validity

The SDMT can be said to be valid for measuring the common objectives which reflect the content of mathematics programs throughout the United States. The intercorrelations among the SDMT form G raw scores and the Otis-Lennon School

Ability Test raw scores for grade 9 students in the blue level fall standardization sample for the applications test were .89 and .76. These correlations indicate that the performance of students on the test agrees with performance as assessed by the related measure.

Reliability of the Myers-Briggs Type Indicator

Split-half scores were used for internal consistency reliability calculations (Willis, 1984). The reliabilities noted are consistent with those of other personality instruments. Reliabilities remain stable up to twenty-five omissions for Form G which can be used to determine which cases should be dropped from a research study. Reliabilities tend to be somewhat lower for respondents in their teens, but stabilize from the twenties onward. High achieving students tend to have more reliable scores than underachieving students. The estimates of internal consistency reliabilities for the continuous scores of the four MBTI scales are acceptable for most adult samples and adequate for younger samples.

Test-retest reliability estimates look at the computations of correlations for the four continuous scores on the MBTI with the issue of type development being a contributor to consistency of preferences. The chance probability of choosing all four preferences on retest is

6.25%. The actual test-retest probabilities are significantly different from chance.

Validity

The validity of the Myers-Briggs Type Indicator is determined by whether it demonstrates the relationships and outcomes predicted by Jung's (1946) theory of psychological types. MBTI data are presented in type distributions and type tables.

Jung's (1946) theory predicts movement of a certain type of personality toward different interests. When occupations, which indicate interest, include a significant number of a type and matched on the type table, construct validity is evidenced. MBTI continuous scores have been correlated with many other scales. Since the MBTI functions have polarity, correlations that match the theoretical characteristics of a preference are significant. For example, E should be positively correlated with measures of sociability: T should not.

Sharp (1987) indicated that typological analysis can be helpful, but also misleading. The validity of a test is statistical and time-specific and there is always a possibility of change.

Classroom Procedures

Staff time required included classroom teacher-time to

explain the study, administer pre and post tests and administer the Myers-Briggs Type Indicator. Computer lab assistant time required included printing a set of computer-generated student results for the study. Classroom time was utilized to explain the study, administer the data gathering instruments, and report type back to students.

Data Collection and Recording

Data collection occurred in the regular classroom through the administration of the testing instruments. Computer-lab data collection occurred through computer-generated statistical reports on the progress of each student. The instruments were scored and the scores returned to the teacher for his information. Scores and type letter-sets were entered into a statistical analysis program.

Data Processing and Statistical Analysis

The ANCOVA analyses for both reading and math were processed by a computer statistical package called SYSTAT (Wilkinson, 1987).

Covariance of the pretest score on the posttest score for both reading and math was the method selected instead of gain scores because analysis of covariance adjusts for usually relatively small differences in pretest or covariate means that have arisen as a function of sampling error.

Gain scores are the least reliable of all difference scores, and difference scores are less reliable than single scores (Mehrens and Lehmann, 1984). Mehrens and Lehmann states that the problem is a high correlation between the pretest and the posttest. Thus, the reliability of the gain score is reduced for individual use. Reliability of gain or difference scores could be valid enough for decisions about groups. Group means are more reliable than individual scores and individual random errors tend to cancel out (Mehrens and Lehmann, 1984).

However, Overall and Woodward (1975) pointed out that difference scores with zero reliability provide a superior basis for rejection of the null hypothesis. These authors pointed out this extreme case of zero reliability to emphasize the reliability paradox to demonstrate that significant treatment effects can be obtained from the analysis of difference scores that have zero reliability. Cronbach and Furby (1970) argued that no matter how gain scores are adjusted or refined, they are rarely useful.

Methodological Assumptions

A fixed-effects model is assumed for the analysis of variance in this study and a significance level of .05 established. The scores are assumed to come from a genuine interval scale. The scores are assumed to be normally

distributed in the population, and the variance in the treatment conditions is assumed to be homogeneous.

Limitations

Because the study was a quasi-experimental design, the internal and external validity of the design was limited. Maturation processes throughout the period after the pretest may have affected the posttest scores. The pretest could have been a learning experience for the subjects that caused a change on the posttest. The history of events that the subjects' were experiencing may have affected their dependent variable scores.

Restatement of Conceptual Hypothesis

H_1: Students in the control group will perform the same for reading as the students using the Integrated Learning System regardless of race or learning style and no interaction will occur between learning styles and race.

H_2: Students in the control group will perform the same for math as the students using the Integrated Learning System regardless of race or learning style and no interaction will occur between learning styles and race.

Summary

The effects of the Integrated Learning System on math

and reading achievement of high school students were examined with race and psychological type/learning style as independent variables. Pre and post tests were given to both the experimental and control groups in reading and math. All subjects were classified as to their psychological type/learning style with the Myers-Briggs Type Indicator. An analysis of covariance was conducted individually on the reading and math scores with race and type/learning style as variables. Cronbach and Snow (1977, p. 507) stated that "When single traits have been studied, some significant variables have been identified that cause interactive main effects in personality styles and learning. However, much of the students' response to instruction cannot be accounted for by a single trait." This study investigated whether the variables of race and psychological type/learning style had any bearing on math and reading scores in an Integrated Learning System environment.

CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

Results

Determination of similarity of the population sample was made by sampling students' national math and reading scores on a standardized test and by examining the math or reading grade from the previous school year. The mean national math percentile ranking of the black control school students was 19.600 and the mean grade point average for math was 1.286. The mean national reading percentile ranking of the black control school students was 30.160 and the mean grade point average for reading was 1.429.

The mean national math percentile ranking of the white control school students was 36.925 and the mean grade point average for math was 1.634. The mean national reading percentile ranking of the white control school students was 48.294 and the mean grade point average for reading was 2.043.

The treatment school had a similar examination of scores to determine population compatibility. The mean national math percentile ranking of the black treatment

school students was 31.762 and the mean grade point average for math was 1.727. The mean national reading percentile ranking of the black treatment school students was 33.850 and the mean grade point average for reading was 1.636.

The mean national math percentile ranking of the white treatment school students was 43.957 and the mean grade point average for math was 1.815. The mean national reading percentile ranking of the white treatment school students was 46.167 and the mean grade point average was 1.815.

Rankings and previous grades were similar enough to define a population with means similar enough from which to draw a sample.

Four learning styles were delineated by Myers (1980) and reinforced with a different emphasis by Keirsey and Bates (1984). The Sensory students (SJs and SPs) have been reported by Myers & McCaulley (1985) from a study by Myers (1962) to comprise about 75 percent of the general population. The Intuitive students (NFs and NTs), on the other hand, comprise about 25 percent of the general population. The results of this study indicated that the sensory population makes up 79 percent of the sample at the treatment school and the Intutives make up 21 percent of the sample at the treatment school of the students who took the MBTI. The control school had 57 percent Sensory and 43 percent Intuitive of the students who took the MBTI. Most of the Intuitives at both schools were white students.

There was a noticeable lack of black Intuitive students. These figures indicate the Intuitive population is not the same as indicated by Myers and McCaulley (1985). Even the extended study did not reveal new intuitive black students. The Intuitive (NF and NT) students were treated as a single learning style because the number of black students in the individual learning styles was too small to constitute two cells.

A 2 X 2 X 3 ANCOVA was the first statistical analysis used to analyze the main effects and interaction between factors. Tables 4 and 5 in the Appendix list the mean scores for reading and math respectively. The overall array of data is included in Table 6. The ANCOVA analysis was chosen because of the statistical control of variables available to the researcher. That analysis follows this discussion. Because of the high student mortality and low number of black Intuitive students and low number of black SJ students, the cell sizes of an ANCOVA could not be made equal or proportional without loss of many subjects. As Pedhazur (1982) stated that sometimes if the F ratio is not significant, separating the variance of extraneous variables from the Error term will result in a smaller error and a larger F ratio. Pedhazur also observed that multiple regression is a superior method of analysis if the cell frequencies in a factorial design are unequal and disproportionate. With this information, a regression was

performed on the data set to test for significance. The discussion on the regression analysis follows the ANCOVA discussion.

ANCOVA

The reading analysis of the 2 x 2 x 3 ANCOVA indicated a significant main effect for the factor of school. A significant F or t indicates that the greater mean (treatment, 57.251; control, 50.163) is significantly larger that the smaller mean. There were no other significant main effects or interactions for either the reading or math segments of the study. Refer to Appendix Table 4 for the list of mean scores for reading. Appendix Table 5 contains a list of mean scores for math.

Progress recorded by the Integrated Learning System (ILS) indicates that the mean unit reading test score by all students was 83.241. The mean unit math test score by all students was 65.949. When scores were compared to race, black students achieved a mean unit reading test score of 81.980 and a mean unit math test score of 65.087. White students achieved a mean unit reading test score of 85.162 and a mean unit math test score of 67.736. Some students entered the program late and did not have as much time to progress through the program. Some students were already proficient readers and progressed rapidly through several reading levels of the ILS program.

A restatement of the null hypothesis is helpful to compare statistics. H1: Students in the Control group will perform the same for reading as the students using the Integrated Learning System regardless of race or learning style with no interaction between race or learning style. H2: Students in the Control group will perform the same for math as the students using the Integrated Learning System regardless of race or learning style with no interaction between race or learning style.

The samples were drawn from populations in which the differences between any two test formats were the same for both black and white students and for all learning styles; the samples were drawn from populations in which the interactions between race and learning style were the same for each school; similarly the interactions between race and school were the same for each level of learning style and the interactions between learning style and school were the same for each race.

Students in the treatment school had a significantly higher mean score for reading than the control school. If the sample means for schools (when averaged across all levels of race and learning style) were drawn from populations with the same mean, the probability of obtaining a mean as disparate as the one obtained in the sample would not be less than 5 percent; therefore, the null hypothesis must be rejected.

If the sample means for learning style (when averaged across all levels of race and school) were drawn from populations with the same mean, the probability of obtaining means as disparate as the ones obtained in the sample would not be less than 5 percent; therefore the null hypothesis must be not be rejected. Similarly, if the sample means for race (when averaged across all levels of learning style and school) were drawn from populations with the same mean, the probability of obtaining means as different as the ones in the sample would be less than 5 percent; therefore the null hypothesis must not be rejected. Populations in both schools generated means which (when averaged across all levels of race and learning style) indicate the sample means would have less than 5 percent probability of being different than general population means; therefore the null hypothesis must not be rejected.

If the sample means were drawn from populations in which the differences between any two learning style-level means were the same for each level of race and school (and the converse), the probability of obtaining differences as discrepant as the ones obtained in the present sample would not be less than 5 percent; therefore the null hypothesis must not be rejected.

Discussion of ANCOVA Results

Do Both Races and All Learning Styles Benefit from the ILS?

It appears from the truncated sample that the benefit gained from the Integrated Learning System in reading is not significantly different for either race (black student means, 52.381; white student means, 55.034) or any of the learning styles (SJ, $\bar{X}$= 53.702; SP, $\bar{X}$= 53.816; NF/NT, $\bar{X}$= 53.604), but, mean scores from both the control ($\bar{X}$= 50.163) and the treatment ($\bar{X}$= 57.251) schools, taking into account the covariance of the pretests and posttests, indicated that the treatment of the Integrated Learning System had a statistically significant positive effect on reading achievement.

The main effect for the school variable for math was nonsignificant. Refer again to Appendix Table 5 for the listing of means. The control school mean (16.866) was slightly different from the treatment school mean (18.002). Similarity of means existed for both races (black students, $\bar{X}$= 16.737; white students, $\bar{X}$= 18.132) and all three learning styles (SJ, $\bar{X}$= 18.320; SP, $\bar{X}$= 16.684; NF/NT, $\bar{X}$= 17.299) with no significant differences. The white students generally performed better than the black students and the SJs performed better than NF/NTs or SPs in that order.

Race achievement by school in math was examined. Although non-significant, some differences existed. White students at the control school ($\bar{X}$= 17.524) performed the same as the black students at the treatment school ($\bar{X}$= 17.254). Control school black students had a mean of 16.209, lower than the above groups; treatment school white students had a mean of 18.740, higher than the above groups.

The SJ learning style students for math at both schools performed equally well along with the NF/NTs of the treatment school as reflected in their respective means (control SJ, $\bar{X}$= 18.119; treatment SJ, $\bar{X}$= 18.520; treatment NF/NT, $\bar{X}$= 18.380). The other learning styles had different means to reflect the different achievement levels (control SP, $\bar{X}$= 16.235; control NF/NT, $\bar{X}$= 15.757; treatment SP, $\bar{X}$= 17.133).

Both races and all learning styles for both reading and math benefitted from the Integrated Learning System.

Which Learning Style Produced the Highest Results with the ILS?

Examination of the reading means of the interaction between the treatment school and learning style, although not significantly different, showed that the mean scores of the SJ learning style and the SP learning style were similar ($\bar{X}$= 58.640 and $\bar{X}$= 58.233 respectively), and the mean scores of the NF and NT learning styles were lower ($\bar{X}$= 54.881) than

the other two learning styles. The SJs and the SPs did equally as well in reading on the linear ILS program.

In math, the SJs ($\bar{X}$= 18.520) and the NF/NTs ($\bar{X}$= 18.380) performed slightly better than the SPs ($\bar{X}$= 17.107). The scores were so similar that the statistical analysis did not locate any significant differences.

Does Race Difference Influence Achievement of Students Using the ILS?

In comparing the four reading means of the black students and the white students in the two schools, both treatment means (black students, $\bar{X}$= 55.518; white students, $\bar{X}$= 58.985) were higher than the control means (black students, $\bar{X}$= 49.244; white students, $\bar{X}$= 51.082). Even though the mean difference is nonsignificant, the discrepancy suggests that there is no difference in performance between black and white students, but performance is increased with the use of the Integrated Learning System. The treatment school performed better in reading through the use of the Integrated Learning System program.

The math means for the main effect of school were similar (control, $\bar{X}$= 16.866; treatment, $\bar{X}$= 18.002) and nonsignificant. The use of the ILS by the treatment school math students had only a small effect on this small sample size.

Interaction Between Race and Learning Style

The reading means of both races interacting with the three (NF and NT combined) learning styles were examined even though they were nonsignificant. See Appendix Table 4 for a listing of the means. The black student means (SJ, $\bar{X}$= 51.044; SP, $\bar{X}$= 52.623; NF/NT, $\bar{X}$= 53.477) were similar to each other in reading; the white student means (SJ, $\bar{X}$= 56.361; SP, $\bar{X}$= 55.010; NF/NT, $\bar{X}$= 53.731) were similar to each other and higher than the black student means. When the race and learning style were examined by school, slight differences were noted. The treatment school SJ and SP black learning styles means (57.161 and 56.122 respectively) were higher for reading than the control school corresponding means (44.926 and 49.124 respectively). The black NF/NT learning style means of both schools (control, $\bar{X}$= 53.683; treatment, $\bar{X}$= 53.271) were similar for reading. All three white learning style means (SJ, $\bar{X}$= 60.120; SP, $\bar{X}$= 60.344; NF/NT, $\bar{X}$= 56.492) for the treatment school were higher than any of the means, black or white, from the control school (black student means listed above; white student means, SJ, $\bar{X}$= 52.602; SP, $\bar{X}$= 49.675; NF/NT, $\bar{X}$= 50.970) although the NF/NT means were slightly lower than the SJ or SP learning style means.

The math means were also examined to see if the interaction between race and learning style, although

nonsignificant, contained differences. The black student SJs ($\bar{X}$= 18.219), the white student SJs ($\bar{X}$= 18.420) and white student NF/NTs ($\bar{X}$= 18.842) achieved a similar level of achievement. The white student SPs ($\bar{X}$= 17.133) achieved at a slightly higher level than the black student SPs ($\bar{X}$= 16.235) and the black student NF/NTs ($\bar{X}$= 15.757).

When Race and Learning Style was examined by school in math, there were interesting differences. Refer to Appendix Table 5 for the listing of mean scores. The treatment school black students that were classified SJ and SP ($\bar{X}$= 18.539 and $\bar{X}$= 17.324 respectively) performed slightly better than the control school black student that were classified SJ and SP ($\bar{X}$= 17.899 and $\bar{X}$= 15.146 respectively). The black students who were classified as Intuitive students performed similarly at both schools (treatment, $\bar{X}$= 15.930; control, $\bar{X}$= 15.583). The treatment school white student means portrayed another image. The SJ students had similar means (treatment, 18.502; control, 18.339). The SP mean differences were reversed from the black student means (treatment, 16.889; control, 17.377). The NF/NT means were widely separated (treatment, 20.829; control, 16.855).

Appendix Table 4 and Table 5 include all ANCOVA means. Because ANCOVA required equal cell sizes, a large number of scores were not used. Table 6 lists the overall array of data. A multiple regression was the analysis chosen to examine the overall array of data.

TABLE 6

OVERALL ARRAY OF DATA

Total Numbers in Both Schools Taking at Least One Test N=960	
Test	**Number**
MBTI	565
MBTI (second time)	66
Math Pretest	547
Math Posttest	262
Reading Pretest	383
Reading Posttest	286
In Treatment Reading Lab	256
Completed at least 1 unit test	191
In Treatment Math Lab	232
Completed at least 1 unit test	191

Control School Numbers Taking Test		Treatment School Numbers Taking Test	
Black Students N=80		Black Students N=294	
Test	**Number**	**Test**	**Number**
MBTI	50	MBTI	176
MBTI (second)	12	MBTI (second)	12
Math Pretest	53	Math Pretest	185
Math Posttest	36	Math Posttest	78
Read Pretest	49	Read Pretest	102
Read Posttest	27	Read Posttest	92
		Math Lab	128
		Completed test	104
		Reading Lab	151
		Completed test	151
White Students N=212		White Students N= 236	
MBTI	154	MBTI	126
MBTI (second)	23	MBTI (second)	9
Math Pretest	129	Math Pretest	117

TABLE 6 (continued)

Control School Numbers Taking Test		Treatment School Numbers Taking Test	
Test	Number	Test	Number
Math Posttest	72	Math Posttest	48
Read Pretest	126	Read Pretest	68
Read Posttest	79	Read Posttest	59
		Math Lab	104
		Completed test	87
		Reading Lab	105
		Completed test	105
Other Students N=	59	Other Students N=	78
Hispanic	9	Hispanic	18
Oriental	5	Oriental	2
Indian	29	Indian	29
No race reported	16	No race reported	30

Regression

Because effects can be influenced by many variables which may be intercorrelated, a set of variables was chosen to observe what portion of variance is accounted for by the total set. As suggested by Pedhazur (1982), a search for the "best" predictors was begun by calculating all possible regression equations. After the R-Square increment was calculated for each variable, a decision on meaningful variables whether statistically significant or not, was made (Pedhazur, 1982). The analysis is predictive to the extent that cause and effect cannot be shown or explained as Pedhazur notes. Some interesting observations can be made by examining the R-Square increments for individual and combinations of variables. The Dependent variable for math was the Math Posttest. The Dependent variable for reading was the Reading Posttest. The total regression model was for math, Math Posttest= Constant + School + Race + Learning Style + School * Race + School * Learning Style + Race * Learning Style + School * Race * Learning Style + Math Pretest. The reading regression model was similar with Reading Posttest substituted for the dependent variable and Reading Pretest substituted for the covariate. Table 7 lists the results of the separate math regression procedures. Table 8 lists the results of the separate reading regression procedures.

TABLE 7

REGRESSION MODELS FOR DEPENDENT VARIABLE MATH (POSTTEST)

Number in Model	R-Square	Variables in Model
1	.285	Math Pretest
1	.006	School
1	.080	Race
1	.006	Learning Style
2	.287	Math Pretest School
2	.294	Math Pretest Race
2	.267	Math Pretest Learning Style
2	.080	School Race
2	.011	School Learning Style
2	.085	Race Learning Style
3	.300	Math Pretest School Race
3	.268	Math Pretest School Learning Style
3	.277	Math Pretest Race Learning Style
3	.085	School Race Learning Style
4	.282	Math Pretest School Race Learning Style

TABLE 8

REGRESSION MODELS FOR DEPENDENT VARIABLE READING (POSTTEST)

Number in Model	R-Square	Variables in Model
1	.594	Reading Pretest
1	.002	School
1	.119	Race
1	.032	Learning Style
2	.633	Reading Pretest School
2	.603	Reading Pretest Race
2	.593	Reading Pretest Learning Style
2	.122	School Race
2	.032	School Learning Style
2	.137	Race Learning Style
3	.653	Reading Pretest School Race
3	.629	Reading Pretest School Learning Style
3	.605	Reading Pretest Race Learning Style
3	.146	School Race Learning Style
4	.648	Reading Pretest School Race Learning Style

Of the three-variable math equations the best combination is Math Pretest, School, and Race (.300) together accounting for 30 percent of the variance. The increment from the best subset of two predictors (Math Pretest, Race .294) to the best subset of three is 2 percent. A test of the increment in proportion of variance accounted for yields a F ratio of 2.264 df= 1 and 264, $p<.05$. The critical F ratio is 3.84. The math increment is not statistically significant.

A similar procedure was followed for reading. The best combination of reading variables is Reading Pretest, School, and Race (.653) which together account for 65 percent of the variance. The increment from the best subset of two predictors (Reading Pretest, School .633) to the best subset of three is about 4 percent. A test of this increment in proportion of variance accounted for yields a F ratio of 15.5642 df=1 and 270, $p<.05$. Critical F ratio is 3.84. The reading increment is statistically significant.

Using a Forward Stepwise Selection, the math variables were analyzed for their contributions to the variance in the Math Posttest. The partial correlations were in order of most contribution: Math Pretest, .512; Race, .300; Learning Style, .084; and School, -.057. The Math Pretest as the covariate contributes 29 percent to the variance in the Math Posttest. The second variable entered into the Forward Stepwise Selection was Race. With the Math Pretest variance

accounted for, Race accounts for 8 percent of the variance in the Math Posttest. The F ratio for Race in the Forward Stepwise Selection was 4.999, df=1, 264, Critical F=3.84, $p<.05$. The Race variable was statistically significant for contributing to the Math Posttest. Learning Style and School were not significant factors in the variance of the Math Posttest and were dropped from the equation in the Forward Stepwise Selection because the tolerance level was insufficient for further computation.

The reading variables were examined similarly. The partial correlations that contributed to the variance in the Reading Posttest are listed in order of their contribution to the variance: Reading Pretest, .768; Race, .364; Learning Style, .182; and School, -.042. The covariate Reading Pretest accounts for 59 percent of the variance in the Posttest. The Pretest was the first to enter the Forward Stepwise Selection analysis. Of the variables not in the equation in step one, the School changed and had the highest partial correlation with the Reading Posttest (.309) and the highest F ratio of 27.580. It was second to enter the equation. The School F ratio of 27.580 for reading was statistically significant (df=1,270; Critical F= 3.84; $p<.05$).

Race and Learning Style were the two variables not in the equation. Race entered in step three with a partial correlation of .225 and F ratio of 13.898. Race, as a

contributor to the variance of the Reading Posttest, is statistically significant with the F ratio of 13.898 (df 1,270; Critical F= 3.84; p<.05). The remaining variable, Learning Style, had an F ratio of .160 which was insufficient to continue the Selection procedure.

A regression analysis was performed on the data that was produced by the computer lab. Variables for both the math section and the reading section were the same. The math regressions will be addressed first. The Average Unit Test Score was considered as the dependent variable. Two internal variables were used to regress separately on the Average Unit Test. One variable was the Average Lesson Score and the other was the Total Time spent on the computer. Race and Learning Style were also used as independent variables in separate regressions. The Average Lesson Score (.489) accounted for 49 percent of the Average Unit Test Score which was significant. The Total Time spent (.104) accounted for 10 percent of the Average Unit Test Score. Total Time spent obtained a t of -4.777 or an F ratio of 22.820 (Critical F= 3.84, df 1, 198, p<.05). Total Time spent on the computer had a statistically significant relationship to the variance on the Average Unit Test Score. The more time the student spent on the computer working math problems, the higher the score. Both Race (.8 percent) and Learning Style (.3 percent) had little to contribute to the

Average Unit Test Score variance and therefore were nonsignificant.

The Math Posttest was designated again as the dependent variable and the Math Pretest, used as a covariate, and the Average Unit Test Score were used as independent variables. These two variables accounted for 35 percent of the total variation of the Math Posttest which was significant. The Average Unit Test Score variable, in a separate regression, accounted for 4.5 percent of the variance. This was an interesting and significant regression with the Average Unit Test Score in math obtaining a t value of 2.181 ($F= 4.755$, $df= 1, 102$, Critical $F=3.84$, $p<.05$).

The Reading Lab computer scores were examined to determine if there were any predictors of the final test score. The Average Unit Test Score was determined to be the dependent variable similar to the math score examination. Independent variables selected to be used in separate regressions with the Average Unit Test Score in reading were the same ones the math section used: Average Lesson Score, Total Time spent, Race, and Learning Style. The Average Lesson Score accounted for a significant 48 percent of the Average Unit Test Score in reading. The Total Time spent was nonsignificant and accounted for only .1 percent of the variance in the Average Unit Test Score ($t=.609$, $F=.3708$, Critical $F=3.84$, $df=1,266$, $p<.05$). Race, although it accounted for only 2 percent of the variance in the Average

Unit Test Score was a statistically significant factor with a F=5.072 (Critical F=3.84, df 1,254, p<.05). Learning Style accounted for .3 percent of the variance was nonsignificant in the variance of the Average Unit Test Score (F=.750, df=1,214, p<.05).

The Reading Posttest was assigned the position of dependent variable with the Average Unit Test Score and the Reading Pretest regressed on it. The two independent variables together accounted for 79 percent of the variance in the dependent variable. The Average Unit Test Score variable accounted for 36 percent of the variance which is statistically significant (t=9.040, df 1,146, Critical t=1.960).

SUMMARY

An Analysis of Covariance was used for the first analysis of the data collected in two Mid-western, urban high schools. Math and reading achievement were measured prior to the treatment of the Integrated Learning System for math and reading. A posttest was administered after the students used the Integrated Learning System. Two factors, race and learning style, which were thought to have some variance on the achievement were also measured. A control school served as a balance for a quasi-experimental design.

Because of extreme student mortality for several reasons, the cell size of the ANCOVA was reduced

considerably to obtain equal cell sizes. Student mortality affects validity; therefore, the ANCOVA results have questionable validity for generalization. General findings for math were that there was no significant main effects for math for either school, race, or learning style, and no significant interaction occurred. Comparison of the adjusted least squares means for math in general (although not significantly so) indicated that the treatment school had a higher mean than the control school, the white students from both schools had higher means than the black students, and the of three learning styles, SJ had the highest mean, NF/NT had the next highest mean, and SP had a lower mean.

Findings for the reading section of the study were that the factor of school had a significant main effect. Race and learning style did not have a significant main effect. No significant interaction between the variables occurred. Comparison of the ANCOVA means (although not statistically significant) indicated that the white students of both schools had a higher mean than the black students. All three learning style means were nearly the same for reading.

Pedhazur (1982) stated that unplanned nonorthogonal (unequal) designs such as this one occur many times the result of subject mortality. The recommendation of this statistician was to use Multiple Regression to analyze the data. Pedhazur asserts that the Multiple

Regression technique is a superior or the only appropriate method of analysis "when cell frequencies in a factorial design are unequal and disproportionate" (pg. 328).

A Multiple Regression was used for data analysis on the larger body of collected data. The Overall Array of Data was presented in Table 6. When variables that accounted for portions of the dependent variable were partialed out, the remaining variables contributed more to the variance. The F ratios became higher and statistical significance was established. Separate Pearson r regressions were run using all possible regression models to establish the correlation for the dependent variable for both reading and math. School significance was still apparent in reading. But, in a Forward Stepwise Selection, Race also was determined to be significant in reading with a F ratio of 13.898 (df=1,270; Critical F=3.84; $p<.05$). The Reading Pretest provided 59 percent of the variation of the Reading Posttest and was partialed out.

In the math section, School became a significant factor with a test of the increment in proportion of variance. Race, too, became significant through a Forward Stepwise Selection and produced 8 percent of the variance in the Posttest. In the Forward Stepwise Selection in math, School and Learning Style did not display significance. The Math Pretest accounted for 29 percent of the variance in the Posttest and was partialed out of the analysis. Learning

Style was never a significant factor in how the Posttest varied.

Within the Computer Lab environment, the significant variable in the math component was the amount of time spent on the computer. Race and Learning Style were not significant contributors in math.

Although time spent on the computer was significant in the math segment, time was not significant in the reading segment. Race was a significant contributor of variance, but Learning Style was nonsignificant.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Summary

The theory base underlying the interest in learning style as a factor was set forth by Jung (1946), developed by Myers (1980) and investigated more by Keirsey and Bates (1984). Learners have preferences for learning. If learners understand their best way of learning, they can cope better with courses taught in ways inconsistent with their style of learning and will therefore empower them to be successful lifelong learners (Claxton and Murrell, 1987). McCaulley (1987) suggested that by approaching problem-solving using each of Jung's (1946) four mental processes (S, N, T, and F), students can learn to become better decision makers. The four-step model teaches students and teachers to be aware of how other people think and that all mental processes are of value. The use of all four processes achieves the best decision. Research shows that students learn best if information to be learned is presented in the preferred learning style modality (Bloom, 1956; Cavanaugh, 1981; Dunn & Bruno, 1985; Henson & Borthwick, 1984).

Race was another element considered as a factor in this study. The Minnesota Multiphasic Personality Inventory (MMPI) studies found that black people who have the higher educational and socioeconomic levels have similar responses as similar white comparison groups on the MMPI (Dahlstrom, Lachar, & Dahlstrom, 1986). Banks (1986) concluded that even with a middle class background, ethnicity continues to significantly influence the learning behavior and styles of Afro-American students. Ramirez (1979) stated that schools historically reflect a North American/Western Europe world view and is trying to assimilate minority members into this world view. Erickson (1987) found that a culturally responsive pedagogy resulted in higher school achievement and morale than was typical of black students. Interethnic leadership skills will lead to less alienation and foster good attitudes toward other races (Ramirez,1979).

Historically educators have been concerned with the failure rate of students. Demographics (Hodgkinson, 1986, 1987, 1988a, 1988b) predict now, more than ever before, the increase of minority students through changing fertility trends and immigration, the prevalence of impoverished, single-parent families, and the rise of emotionally or mentally handicapped babies. The increase of minority dropouts has already been observed. The division of interest in the future between a large segment of elderly who need care and the large segment of students charac-

terized by the factors mentioned above will add to the school system's woes of trying to educated these students. Race differences may have an impact on classroom learning.

Educators try many strategies to educate students. Learning style application has been one strategy. Another tactic has been the incorporation of computers into the classroom setting. The Integrated Learning System is one type of program utilized to facilitate instruction. Run from networked workstations, the central computer pretests, manages student lessons, and generates score results for each student.

In examining the Integrated Learning System as a treatment in a quasi-experimental study, some differences were noted and are discussed shortly. A high number of students were involved in the study with teachers administering the tests. Student mortality occurred and many subjects did not take all three tests which reduced the actual number that could be statistically analyzed. The planned ANCOVA was used for the first analysis which produced a statistically significant main effect for the School variable. A Multiple Regression was then applied to the data. By partialing out variables, more significance was detected.

Conclusions

The Problem

The problem stated was to discover if black or white high school students perform differently in the Integrated Learning System (ILS) environment, if learning style was a factor in achievement, and if there was any interaction between race and learning style on achievement through use of the ILS.

The Methodology

The Academic Study Skills class at the treatment school administered the Gates-MacGinitie Reading Test at the beginning of each quarter of school and administered a different form of the test at the end of each quarter in a pretest-posttest design. The class attended the Josten's Computer lab and used the Integrated Learning System. The Myers-Briggs Type Indicator was administered in all four Academic Study Skills sections during the first quarter. Several classes of General and Personal Math participated by administering the Application section of the Stanford Diagnostic Math Test as a pretest and as a posttest after attending the computer lab. Each class administered the Myers-Briggs Type Indicator sometime during the school year. MBTI Report forms were returned to each student taking the Indicator which related the reported type and an explanation

of type characteristics. Also included with the report forms were one-page descriptions of the reported type characteristics and a page which listed learning style characteristics of each type.

The control school administered the math and reading tests in the English 9 and General and Personal Math classrooms. The Myers-Briggs Type Indicator was also given in the classrooms. The MBTI Report form was returned to each student who completed the MBTI as well as the pages on type characteristics and the learning style characteristics of the types. The English 9 classes were tested in different school quarters to simulate the rotation of the Academic Study Skills classes at the treatment school.

The Integrated Learning System at the treatment school pretested each student for placement within the program for both the reading level and the math level. Students worked at their own pace through the lessons, progressing to the next level after successfully completing one level. The report generated by the Josten's program summarized the work results of each student. The report listed the total time the student spent on the series of lessons, the average number of lessons completed, the average lessons per week, the percentage of the average lesson score, the total number of unit tests taken, the percentage of the average percentage of unit tests, and the final level obtained.

A 2 X 2 X 3 ANCOVA was used to analyze the data. The computer program SYSTAT was utilized to process the data.

The Findings

A SYSTAT analysis using ANCOVA with the math pretest being the covariate found nonsignificance in all but the school factor of the reading section. A significant F indicates that the greater mean (treatment) is significantly larger that the smaller mean (control). Statistically, the null hypothesis of no differences in race, or learning style must not be rejected. The statistically significant difference in the school means in reading indicates that the null hypothesis with the ANCOVA analysis must be rejected. There is a difference between school means in reading.

Examination of the SYSTAT means analysis shows that there is a slight difference in means in both reading and math but not statistically different. All treatment school students, both black and white, had a higher achievement in reading than students at the control school. Although not statistically significant, treatment school math means were higher than control school means. White student means tended to be higher than the black student means but not significantly so. In general, black and white students for all learning styles performed the same for math. School membership was significant in reading achievement for both black and white student for all learning styles.

Because of the unequal and disproportionate cell sizes, the number of subjects was altered considerably to form equal cells for the ANCOVA. Pedhazur (1982) recommended a Multiple Regression for such a case. A regression analysis was performed on the data with more significance emerging. School significance for reading still appeared. With the removal of variables via a Forward Stepwise Selection, notation of more variance with the remaining variables was possible. Race became a significant factor in the reading section. School and Race showed significance in the math section. The ANCOVA, given enough per cell, would have allowed equal comparison between the means of the variables. The Multiple Regression helped to establish exactly what part each variable performed in the variance of the dependent variable.

Recommendations

The Integrated Learning System facilitated learning for both black students and white students. It is recommended that all students continue processing through the computer lab regardless of learning style or race. Reading seems to be directly affected by the Integrated Learning System. Reading skills will be helped by continuing computer lab work. Differences in Race contribute to differences in test scores. Since the amount of time spent on math in the Computer Lab was significant, it is recommended that

teachers correlate their lesson plans to address the sequence of the Integrated Learning System and allow more time for slower students to process the information. Also, since the Integrated Learning System allows a student to take up where he left off in the lesson, no gaps of information are missing for a student who has been absent.

Rigney (1978) suggested that not only the content be taught, but the student should be given a choice from a list of strategies he can employ to solve problems. The ILS does not do that, but it is recommended that the teachers create a list of strategies with explanations in writing that the student could use both with the computer problems and with homework problems. The writing down of instructions is important because Erickson (1978) says there is a cultural difference in listening and speaking. A culturally responsive pedagogy, which is recommended, would include written instructions as well as verbal instructions.

Even though Learning Style was not statistically significant, student temperaments discovered by the MBTI indicate that interpersonal experience could supplement the computer lab experience. Extra attention and encouragement for those with a lower performance level or those who are identified with the Myers-Briggs "F" or Feeling temperament might facilitate the computer lab strategy.

Research of the Literature reveals the positive effects of teaching to the learning style in the traditional

classroom. The demographics that predict a future student population consisting mainly of minorities should be enough to spur school systems into planning for these minorities. The innovative programs begun by the treatment school for the large black population along with the Integrated Learning System appears to produce positive results at least as good as the traditional classroom in both reading and math. Culturally aware and interactive schools will help prepare schools for the coming minority population.

The inconvenience that the testing seemed to cause in the school setting both in the classroom and in the extra testing sessions was disturbing. The desire to cooperate by the teachers with the school system and the need to complete their own lesson plans placed some teachers in a conflicting situation. The teachers could not control the attendance or continued student status of the students and, therefore, had no way of having students complete the three tests. It is recommended that for studies needing large numbers for statistical power the test requirement be kept to a one-test design to prevent student mortality.

The concept of cooperating with other school systems is practical. The La Joya, Texas, school system (Dervarics, 1991) was able to cooperate with the Washington state school system to enable students to continue from where they left off in an ILS. The mobility of students often prevent continuity of education. A cooperative system perhaps using

an ILS could provide continuity for this population and offer a measure of success for those who often do not succeed.

The learning styles concept is still a valid notion. This study found slight difference in learning style performance with a computer lab treatment. Student and teacher awareness of learning style characteristics did occur during this study. Student knowledge of individual learning style should still be promoted to empower the student to become a confident learner.

REFERENCES

Allen, B. S., & Merrill, M. D. (1985). System-assigned strategies and CBI. Educational Computing Research. 1(1). 3-21.

Arraj, T., & Arraj, J. (1985). A tool for understanding human differences How to discover and develop your type according to Dr. C. G. Jung and Dr. William Sheldon. Chiloquin, OR: Tools for Inner Growth.

Balajthy, E. (1986). Microcomputers in reading and language arts. Englewood Cliffs, NJ: Prentice-Hall.

Balajthy, E. (1988, March). Recent trends in minicomputer-based integrated learning systems for reading and language arts instruction (Report No. IR 013 405). New Brunswick, NJ: Rutgers University Spring Reading Conference. (ERIC Document Reproduction Service No. ED 298 937)

Banks, J. A. (1988). Ethnicity, class, cognitive, and motivational styles: Research and teaching implications. Journal of Negro Education. 57. 52-466.

Beady, C., & Slavin, R. (1980). Making success available to all students in desegregated schools. Integrated Education. 18. 5-6, 28-31.

Bloom, B. S. (1956, Ed). Taxonomy of educational objectives: Handbook I: Cognitive domain. New York: David McKay.

Bracey, G. (1991, September), ILS research isn't helpful. Electronic Learning. 11(1), 16.

Cavanaugh, D. P. (1981). Student learning styles: A diagnostic/prescriptive approach to instruction. Phi Delta Kappan 63. 202-203.

Claxton, C. S., & Murrell, P. H. (1987). Learning styles: Implications for improving education practices (ASHE-ERIC Higher Education Report No. 4). Washington D. C.: Association for the Study of Higher Education.

Cronbach, L. J., & Furby, L. (1970). How we should measure "change" or should we? Psychological Bulletin. 74(1). 68-80.

Cronbach, L. J., & Snow, R. E. (1977). Aptitudes and instructional methods. New York: Irvinton.

Curry, L. (1983, April). An organization of learning styles: Theory and constructs (Report No. TM 830 554). Paper presented at the Annual Meeting of American Educational Research Association. New York. (ERIC Document Reproduction Service No. ED 235 185)

Dahlstrom, W. G., Lachar, D., & Dahlstrom, L. E. (1986). MMPI patterns of American minorities. Minneapolis: University of Minnesota.

DeLaszlo, V. S. (Ed.). (1959). The basic writings of C. G. Jung. New York: Random House.

Dervarics, C. (1991, October), Learning systems even the odds. The Electronic School. pp. A21-A22.

Dunn. R. (1981). Teaching in a purple fog: What we don't know about learning style. NASSP Bulletin. 65(443). 33-36.

Dunn, R. (1983). Can students identify their own learning styles: Educational Leadership. 40(5). 60-62.

Dunn, R. (1984). Learning style: State of the science. Theory into Practice. 23(1). 10-19.

Dunn, R., Beaudry, J. S., & Klavas, A. (1989). Survey of research on learning styles. Educational Leadership. 46(6). 50-58.

Dunn, R., & Bruno, A. (1985). What does the research on learning styles have to do with Mario? Clearing house. 59(1). 9-12.

Dunn, R., & Carbo, M. (1981). Modalities: An open letter to Walter Barbe, Michael Milone, and Raymond Swassing. Educational Leadership. 38. 391-382.

Dunn, R., DeBello, T., Brennan, P., & Murrain, P. (1981). Learning style researchers define differences differently. Educational Leadership, 38(5). 372-375.

Dunn, K., & Dunn, R. (1987). Dispelling outmoded beliefs about student learning. Educational Leadership. 44(6). 55-62.

Dunn, R., & Dunn, K. (1984). Ten ways to make the classroom a better place to learn. Instructor. 94(4). 84-86, 88, 139.

Dunn, R., Dunn, K., & Price, G. E. (1978). Learning style inventory. Lawrence, KS: Price Systems.

Emihovich, C., & Miller, G. E. (1988). Effects of Logo and CAI on black first graders' achievement, reflectivity, and self-esteem. The Elementary School Journal. 88. 473-487.

Erickson, F. (1987). Transformation and school success: The politics and culture of educational achievement. Anthropology & Education Quarterly. 18. 335-356.

Femminella, F. X. (1979, December). Education and ethnicity: Euro-ethnics in anglo-ethnic schools (Report No. SO 012 365). Paper presented to the United States Commission on Civil Rights at a Consultation entitled: Civil Rights Issues of Euro-Ethnic Americans in the United States: Opportunities and Challenges. Chicago, IL. (ERIC Document Reproduction Service No. ED 183 439)

Ferrell, B. (1988). Using the NASSP Learning Style Profile. In J. W. Keefe (Ed). Profiling and utilizing learning style. (Report No. SP 030 018). Reston, VA: National Association of Secondary School Principals. (ERIC Document Reproduction Service No. ED 292 772)

Gagne', R. M. (1971). Learning research and its implications for independent learning. In R. A. Weisgerber (Ed.). Perspectives in individualized Learning (pp. 12-30). Itasca, IL: F. E. Peacock.

Gagne', R. M. (1977). The conditions of learning (3rd ed.). New York: Holt, Rinehart, and Winston.

Golay, K. (1982). Learning patterns & temperament styles: A systematic guide to maximizing student achievement. Fullerton, CA: MANAS-SYSTEMS.

Gregorc, A. F. (1984). Style as a symptom: A phenomenological perspective. Theory into Practice 23(1). 51-55.

Gregorc, A. F., & Butler, K. A. (1984). Learning is a matter of style. VocEd. 59(3). 27-29.

Hale-Benson, J. E.(1986). Black children: Their roots, culture, and learning styles. (Revised ed.). Baltimore: Johns Hopkins University.

Henson, K. T., & Borthwick, P. (1984). Matching styles: A historical look. Theory into Practice. 23(1). 3-9.

Hirsh, S., & Kummerow, J. (1989). Lifetypes. New York: Warner Communications.

Hodgkinson, H. (1986). Guess who's coming to work (Report No. CE 044 501). Columbus, OH: Ohio State University. National Center for Research in Vocational Education. (ERIC Document Reproduction Service No. ED 269 646)

Hodgkinson, H. (1987). Today's curriculum--how appropriate will it be in year 2000? NASSP Bulletin. 71(498). 2-4, 6-7.

Hodgkinson, H. (1988a). The right schools for the right kids. Educational Leadership. 45(5). 10-14.

Hodgkinson, H. (1988b, October). The context of 21st-century civics and citizenship (Report No. SO 020 220). Paper presented at the National Conference on the Future of Civic Education. Washington, DC (ERIC Document Reproduction Service No. ED 310 984)

Jacobi, J. (1943). The psychology of Jung. New Haven: Yale University Press.

Jenkins, J. M. (1988). A learning style approach to effective instruction. In J. W. Keefe (Ed.), Profiling and utilizing learning style. (Report No. SP 030 018). Reston, VA: National Association of Secondary School Principals. (ERIC Document Reproduction Service No. ED 292 772)

Jostens Learning Corporation. (1989, December). Overview statements. Integrated Learning System Overview Manual. (Available from Jostens Learning Corporation, 2416 Bengal Lane, Plano, TX, 75023).

Jung, C. G. (1946). Psychological types: Or the psychology of individuation. New York: Harcourt, Brace, and Co.

Karrer, U. (1988). Comparison of learning style inventories (LSI) (Report No. IR 013 396). Seon, Switzerland. Author: (ERIC Document Reproduction Service No. ED 296 713)

Keefe, J. W. (1986). Learning style profile: Examiner's manual. Reston, VA: National Association of Secondary School Principals.

Keefe, J. W. (1987). Learning style: Theory and practice. Reston, VA: National Association of Secondary School Principals.

Keefe, J. W. (Ed.). (1988). Profiling and utilizing learning style. (Report No. SP 030 018). Reston, VA: National Association of Secondary School Principals. (ERIC Document Reproduction Service No. ED 292 772)

Kehoe, J. (1983). Enhancing the multicultural climate of the school. History and Social Science Teacher. 19(2). 6-75.

Keirsey,D., & Bates, M. (1984). Please understand me. Del Mar, CA: Prometheus Nemesis.

Kolb, D. A. (1978). Learning style inventory: Technical manual (rev. ed.). Boston: McBer.

Komoski, P. K. (1987). Educational technology: The closing-in or the opening-out of curriculum and instruction (Report No. R 013 427). Syracuse, NY: Information Resources. (ERIC Document Reproduction Service No. ED 295 676)

Lawrence, G. (1982). People types & tiger stripes: A practical guide to learning styles (2nd ed.). Gainesville, FL: Center for Application of Psychological Type.

Leigh, J. (1986). The personality factor. San Francisco: Airborne Press.

Lemmon, P. (1985). A school where learning styles make a difference. Principal. 64(4). 26-28.

McCarthy, B. (1981). The 4mat system: Teaching to learning styles with right/left mode techniques (2nd ed.). Oak Brook, IL: Excel.

McCarthy, R. (1989). The advantages of using a network. Electronic Learning. 33-38.

McCaulley, M. H. (1987). The Myers-Briggs Type Indicator: A Jungian model of problem solving. New Directions for Teaching and Learning, (Developing critical thinking and problem-solving abilities). 30. 37-53.

Mageau, T. (1992, January). Integrating an ILS: Two teaching models that work. Electronic Learning. 11(4), 16-22.

Mehrens, W. A., & Lehmann, I. J. (1984). Measurement and evaluation in education and psychology (3rd ed.). New York: Holt, Rinehart, and Winston

Messick, S., & Associates (1976). Individuality in learning: Implications of cognitive styles and creativity for human development. San Francisco: Jossey-Bass.

Myers, I. B. (1980). Gifts differing. Palo Alto, CA: Consulting Psychologists Press.

Myers, I. B., & McCaulley, M. H. (1985). Manual: A guide to the development and use of the Myers-Briggs Type Indicator. Palo Alto, CA: Consulting Psychologists Press.

Ogbu, J. U. (1987). Variability in minority school performance: A problem in search of an explanation. Anthropology & Education Quarterly. 18. 312-335.

Overall, J. E., & Woodward, J. A. (1975). Unreliability of difference scores: A paradox for measurement of change. Psychological Bulletin. 82(1). 85-86.

Page, R. (1987). Teachers: perceptions of students: A link between classrooms, school cultures, and the social order. Anthropology & Education Quarterly. 18

Pedhazur, E. J. (1982). Multiple regression in behavioral research: Explanation and prediction (2nd ed.). Fort Worth: Holt, Rinehart, and Winston.

Price, G., Dunn, R., & Sanders, W. (1981). Reading achievement and learning style characteristics. Clearing House. 4. 223-226.

Ramirez, M. III. (1979, October). Cultural democracy and the multicultural personality: Effective leadership for a diverse society (Report No. RO 012 003). An Inaugural Lecture given at Oakes College (Santa Cruz, CA). (ERIC Document Reproduction Service No. ED 186 173)

Ramirez, M., III. (1982, March). Cognitive styles and cultural diversity (Report No. UD 022 310). Paper presented at the annual meeting of American Educational Research Association. New York. (ERIC Document Reproduction Service No. ED 218 380)

Rigney, J. W. (1978). Learning strategies: A theoretical perspective. Learning Strategies. New York: Academic Press

Romiszowski, A. J. (1986). Developing auto-instructional materials. New York: Nichols.

Rowland, P., & Stuessy, C. L. (1986). Matching mode of CAI to cognitive styles: An exploratory study. Journal of Computers in Mathematics and Science Teaching. 7(4). 36-40, 55.

Shade, B. J. (1979). Racial preferences in psychological differentiation: An alternative explanation for group differences (Report No. UD 020 01). Madison, WI: Wisconsin University Center Royalty Fund Committee. (ERIC Document Reproduction Service No. ED 179 672)

Shade, B. J. (1984, April). Afro-American patterns of cognition: A review of research (Report No. UD 923 67); Paper presented at the annual meeting of the American Educational Research Association. New Orleans, LA. (ERIC Document Reproduction Service No. ED 244 025)

Sharp, D. (1987). Personality types: Jung's model of typology. Toronto, Canada: Inner City Books.

Sherry, M. (1992, March). Integrated learning systems: The Mac pack. Electronic Learning Special Edition, 11(6), 12-18.

Snelbecker, G. E. (1974). Learning theory, instructional theory, and psychoeducational design. New York: McGraw-Hill.

Stahl, S. A. (1985). Gates-MacGinitie reading tests, Second Edition. In D. J. Keyser & R. C. Sweetland (EDS.). Test critiques: Vol. 4. (pp. 310-319). Kansas City, MO: Test Corporation of America.

Terrell, F., & Terrell, S. L. (1981). Effects of type of reinforcement on the intelligence test performance of retarded black children. Psychology in the Schools. 18

Twiss, B. (1989). An information proposal: In response to general specifications for instructional computer labs. (Available from Jostens Learning Corporation, 2416 Bengal Lane, Plano, TX, 75023)

Wilkinson, L. (1987). SYSTAT: The system for statistics. Evanston, IL: SYSTAT, Inc.

Willis, C. G. (1984). Myers-Briggs Type Indicator. In D. J. Keyser & R. C. Sweetland (Eds.). Test Critiques: Vol. 1 (pp. 462-490). Kansas City, MO: Test Corporation of America.

APPENDIX

ADJUSTED LEAST SQUARES MEANS TABLES

TABLE 4

ADJUSTED LEAST SQUARES MEANS FOR READING

Factor or Factor Interaction	Name	Adjusted Least Squares Means	Number
School	Control	50.163	54
School	Treatment	57.251	54
Race	All Black	52.381	54
Race	All White	55.034	54
Learning Style 1	All SJ	53.702	36
Learning Style 2	All SP	53.816	36
Learning Style 3	All NF And NT	53.604	36
School Race	Control Black	49.244	27
School Race	Control White	51.082	27
School Race	Treatment Black	55.518	27
School Race	Treatment White	58.985	27
School Learning Style 1	Control SJ	48.764	18
School Learning Style 2	Control SP	49.399	18
School Learning Style 3	Control NF and NT	52.326	18

TABLE 4 (continued)

Factor or Factor Interaction	Name	Adjusted Least Squares Means	Number
School Learning Style 1	Treatment SJ	58.640	18
School Learning Style 2	Treatment SP	58.233	18
School Learning Style 3	Treatment NF and NT	54.881	18
Race Learning Style 1	All Black SJ	51.044	18
Race Learning Style 2	All Black SP	52.623	18
Race Learning Style 3	All Black NF and NT	53.477	18
Race Learning Style 1	All White SJ	56.361	18
Race Learning Style 2	All White SP	55.010	18
Race Learning Style 3	All White NF and NT	53.731	18
School Race Learning Style 1	Control Black SJ	44.926	9
School Race Learning Style 2	Control Black SP	49.124	9
School Race Learning Style 3	Control Black NF and NT	53.683	9

TABLE 4 (continued)

Factors or Factor Interactions	Name	Adjusted Least Squares Means	Number
School Race Learning Style 1	Control White SJ	52.602	9
School Race Learning Style 2	Control White SP	49.675	9
School Race Learning Style 3	Control White NF and NT	50.970	9
School Race Learning Style 1	Treatment Black SJ	57.161	9
School Race Learning Style 2	Treatment Black SP	56.122	9
School Race Learning Style 3	Treatment Black NF and NT	53.271	9
School Race Learning Style 1	Treatment White SJ	60.120	9
School Race Learning Style 2	Treatment White SP	60.344	9
School Race Learning Style 3	Treatment White NF and NT	56.492	9

TABLE 5

ADJUSTED LEAST SQUARES MEANS FOR MATH

Factor or Interaction	Name	Adjusted Least Squares Means	Number
School	Control	16.866	60
School	Treatment	18.002	60
Race	All Black	16.737	60
Race	All White	18.132	60
Learning Style 1	SJ	18.320	40
Learning Style 2	SP	16.684	40
Learning Style 3/4	NF and NT	17.299	40
School Race	Control Black	16.209	30
School Race	Control White	17.524	30
School Race	Treatment Black	17.264	30
School Race	Treatment White	18.740	30
School Learning Style 1	Control SJ	18.119	20
School Learning Style 2	Control SP	16.261	20
School Learning Style 3/4	Control NF and NT	16.219	20
School Learning Style 1	Treatment SJ	19.520	20

TABLE 5 (continued)

Factor or Interaction	Name	Adjusted Least Squares Means	Number
School Learning Style 2	Treatment SP	17.107	20
School Learning Style 3/4	Treatment NF and NT	18.380	20
Race Learning Style 1	Black SJ	18.219	20
Race Learning Style 2	Black SP	16.235	20
Race Learning Style 3/4	Black NF and NT	15.757	20
Race Learning Style 1	White SJ	18.420	20
Race Learning Style 2	White SP	17.133	20
Race Learning Style 3/4	White NF and NT	18.842	20
School Race Learning Style 1	Control Black SJ	17.899	10
School Race Learning Style 2	Control Black SP	15.146	10
School Race Learning Style 3/4	Control Black NF and NT	15.583	10

TABLE 5 (continued)

Factor or Interaction	Name	Adjusted Least Squares Means	Number
School Race Learning Style 1	Control White SJ	18.339	10
School Race Learning Style 2	Control White SP	17.377	10
School Race Learning Style 3/4	Control White NF and NT	16.855	10
School Race Learning Style 1	Treatment Black SJ	18.539	10
School Race Learning Style 2	Treatment Black SP	17.324	10
School Race Learning Style 3/4	Treatment Black NF and NT	15.930	10
School Race Learning Style 1	Treatment White SJ	18.502	10
School Race Learning Style 2	Treatment White SP	16.889	10
School Race Learning Style 3/4	Treatment White NF and NT	20.829	10

VITA

Doris Kay Phelps Smith

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE EFFECT OF A COMPUTER-BASED INTEGRATED LEARNING SYSTEM ON THE ACADEMIC ACHIEVEMENT OF HIGH SCHOOL STUDENTS BY RACE AND LEARNING STYLE

Major Field: Applied Behavioral Studies

Biographical:

Personal Data: Born in Pueblo, Colorado, April 21, 1944, the daughter of Lloyd A. and Velma Allison Phelps.

Education: Graduated from Farmington High School, Farmington, New Mexico, in May of 1962; attended University of New Mexico, Albuquerque, New Mexico; attended University of North Dakota at Williston, Williston, North Dakota; attended Central State University, Edmond, Oklahoma; received Bachelor of Science Degree in Home Economics from Northeastern State University, Tahlequah, Oklahoma in December, 1982; received Master of Science Degree in Junior College Teaching from Northeastern State University, Tahlequah, Oklahoma in August, 1984; completed requirements for the Doctor of Philosophy Degree at Oklahoma State University, Stillwater, Oklahoma, in July, 1992.

Professional Experience: Substitute teacher, Broken Arrow School System, 1982-1984; teacher at Broken Arrow Community Education, 1983; Tulsa VoTech Math Advisory Committee, 1986-1991; Educational Coordinator, Frances E. Willard Home for Girls, 1984-1992.

Professional Organizations: Association for Supervision and Curriculum Development